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Mapping Dynamic Relations in Sound and Space Perception

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Degree of
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Music, Technology and Innovation

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ABSTRACT

The research investigates the dynamic relations between sound, space and the audience perception as related to an artist's intention. What is the relation between sound and space in the sonic arts, and to what kind of merger does it lead? What relationship exists between the intention of the composer and the perception of the audience regarding architectural and environmental spaces? Is there a common thread of perception of architectural and environmental spaces among participants? Is embodiment a key for the perception of the dynamic relations of sound and space?

The framework for the investigation is based on a map of three defined spaces (Real, Virtual, and Hyperbiological) included in a portfolio of six works (three electroacoustic compositions, two sound installations, and one performance), which lead to the analysis of the perception of space, namely, the perception of architectural and environmental spaces as required by the portfolio. The original knowledge resides in the exploration of a potential common representation (space and sound perception being, of course, a personal representation) of internal perceptual spaces and mental imageries generated by the works. The act of listening plays a major role in the development of the portfolio presented and includes Pauline Oliveros' concept of *deep listening* (Oliveros 2005).

Sound and space are intimately related in the portfolio. One particular element emerging from this relationship is the plastic quality of sound, meaning that sound is considered and observed as a material that is shaped by space. From this perspective the research investigates the 'sculptural' and morphological quality of the relationship between sound and space. The results include the specific language and signature of the artworks that delineate the intersection of music and fine arts. The portfolio pays a large tribute to several iconic artists present in the outposts of sound blurred by space. Composers and artists are therefore presented in the theoretical section in order to highlight how their pioneering works have influenced and informed the present research portfolio. The analysis of the perception of the artworks relates to a methodology based on an empirical survey inspired by phenomenology.

CHAPTER ONE
INTRODUCTION

The present epoch will perhaps be above all the epoch of space. We are in the epoch of simultaneity: we are in the epoch of juxtaposition, the epoch of the near and far, of the side-by-side, of the dispersed (…) Our epoch is one in which space takes for us the form of relations among sites – M. Foucault

1.1. Introduction

The present research explores aesthetic and perceptual issues linked to the mapping of the dynamic relations in sound and space perception. A merger between sound and space in defined contexts of sonic arts[1] is sought. How is this merger perceived? Is there a common thread when these issues are proposed to an audience?

In Section 1.2 a background of work exploring sound and space is proposed as the organisation of sound masses in space, reduced listening, and deep listening. The typology of spaces in relation to the listening modes and mental imagery are introduced. The audience perception of the work is proposed as an important issue of the study and includes the role of embodiment.

In Section 1.3. Maryanne Amacher, Max Neuhaus, and Alvin Lucier are presented as precursors for their research into the roles of sound and space in the current study. In Section 1.4. the map of the three types of space investigated in the current study are presented as real, virtual, and hyperbiological. In Section 1.5. the aims, objectives, and personal motivations are presented. In Section 1.6. the research questions of the study are defined. In Section 1.7. the support of the research by the portfolio is demonstrated through the research process, the mapping of the artworks, and the mapping of the spaces as diagrams. In Section 1.8. the question of documenting site-specific artworks is approached. In Section 1.9. the six pieces of the portfolio are introduced.

[1] In the current research, 'sonic arts' are understood as music that goes beyond notes, including composition as well as sound installations and performances in which sound plays a fundamental role and promotes a specific dedication to listening.

Firstly, the *original knowledge* provided by the project resides in the observation of the process of development of an original portfolio investigating the dynamic relations of sound and space, and for which a map of three spaces is developed. The portfolio includes six different pieces, which are introduced at Section 1.9 and detailed in Chapter Three (*The Fall, De Rerum Natura, My Extra Personal Space, Kinetism, Music for Brainwaves and Voices from the Coalmine*). They are distributed into three categories, namely, fixed-medium composition, sound installations, and performance. The pieces may belong to more than one category. In this context, the portfolio investigates the merger emerging from the relation between sound and space. The following terms are key in the development of the portfolio:

- *Listening* is approached through *deep listening,* 'a practice that is intended to *heighten* and expand consciousness of sound in as many dimensions of awareness and attentional dynamics as humanly possible' (Oliveros 2005: xxiii). However, it also includes the modes of listening derived from the Oliveros approach (e.g. reduced listening, heightened listening). In addition, the German philosopher, Gernot Böhme underlines that 'the best existing model for describing listening proposes that one inwardly re-enacts that which is heard' (Böhme 2000:18). In this way, the acoustic space expands, by re-enactment, from outside to inside the body.
- *Soundwalking* in the urban and natural environment allows a comprehension of the *site* (of the sound) for the author through listening.
- *Sound objects*

  These emanate from the reduced listening mode, in the sense that they are removed from their original contexts.
- *Site-specificity*

  > Such practice draws upon the given parameters and situation and incorporates them into the making and presentation of the work itself. In this way, it is contextually aware, producing not so much an object of attention but a set of conditions by which context is brought into focus.' (LaBelle 2006: 15)

LaBelle's proposal is contextualised in the current research as sound installations:

> Installations are context-sensitive with regard not only to the interior or exterior space in which they are exhibited but also to the social frameworks that influence the reception of art in general (…) the aesthetic concept of installation must be thought of – in its ambiguity – as based on the concept of *Ge-stell*[2] of the process of aesthetic experience that 'set up and set forth' (…) The autonomous logic of the aesthetic can be understood only with reference to the structure of aesthetic experience. (Rebentisch 2012: 221, 239)

Therefore, the sound installation relates to the environment through a set of defined conditions, which are enframed in order to deliver the aesthetic experience. The aesthetic experience develops through embodiment, which is the *felt* atmosphere as a relation between the viewer/auditor and the work of art.

- *Embodiment*

> The centrality of world to embodiment has been a common theme of phenomenological thinking. Husserl's notion of the 'life-world', for instance, highlights 'the intersubjective, mundane world of background understandings and experiences of the world (Dourish in Boellstorff 2011: 513)

Thus, in order to embody the artworks, those have to be experienced, by the audiences' walking into them, or by deep listening.

Secondly, the research focuses on the investigation of perception through the observation of mental imagery triggered by the audiences' experience of the portfolio. It leads to perceptions of the approach to the phenomenal world that lies in the auditory cortex about one's personal architectural and environmental

[2] Enframing.

spaces. In this sense the experience *is* the artwork. Thus, the idea resides in including the artist's intention and audiences' perceptions into the same loop in order to create a direct link between them (Blanke, Forcucci and Dieguez 2009). Space is approached from an architectural angle, meaning that it is not only a container defined by borders and geometrical values, '*the Receptacle not a Void'* (Casey 1998: 33), but mostly a sum of relations between architectural elements and sites (of sounds), 'providing a situation [*hedran*] for all things that come into being' (*Ibid*: 33). Casey observes also that:

> For if it is true that space is determined entirely by relations, then what matters most is not the size or shape of space, its capacity or volume, but the exact positions of the items related to each other in a given spatial nexus. (*Ibid:* 182)

The architectural approach refers to spatial relationships between sound and space, and how the resonance, reverberation, and vibrational properties influence sound in space and vice versa. Such relationships define a sonic architecture, which is an immaterial architecture, an architecture of atmosphere. As a sonic immaterial architecture, the only way to experience it is through listening. Thus the movement and the perception of the body in mental imageries are also important components allowing an embodiment of the architectural sonic space through sound, which leads to its embodiment in mental imagery. In the current context, the idea of atmosphere relies on the relationships engaging sound, space (architectural and/or environmental) and the body. The sum of the relationships is *felt* and *is* actually the atmosphere that consequently *affects* and leads to perception *within* the body of the auditor. Böhme proposes that:

> Perception is basically the manner in which one is bodily present for something or someone or one's bodily state in an environment. The primary 'object' of perception is atmospheres. (Böhme 1993: 125)

The primary 'object' of perception is atmosphere; therefore, in the context of atmospheric architectures it is the *felt* architecture, and even the

relationship that is established between the architecture and the body of the viewer/auditor. Consequently the body becomes part of the work. As examples of atmospheric architectures, the New Yorkers architects Diller and Scofidio + Renfro proposed their *Blur Building* at the Swiss Expo in 2001, which 'is an architecture of atmosphere – a fog mass resulting from natural and manmade forces' (Diller Scofidio + Renfro 2001). Dissimilarly, the Swiss architect Peter Zumthor designed the *Swiss Sound Box* for the Hannover Expo 2000, a pavilion made of wood stacks:

> What makes the *Swiss Sound Box* distinct is that it is more than a mere amplified and scaled instrument to encompass the human body – the instrument as building, rather in this case, it is the building that is an instrument – a device and an apparatus that orchestrates movement, sound, smells, vision. (Kanekar 2015: 83)

The role of the movement of the body is paramount in Zumthor's *Swiss Sound Box* architecture, and the related embodiment of space is made through sound, smells, and vision. In the work of the artist Olafur Eliasson there is the inclusion, in addition to the idea of architecture of atmosphere, of the notion of *affect*, described by Frichot as:

> Affect is the movement between emotional registers rather than the emotion itself once it can be named. Likewise, the percept is less about the named perception than what happens in the encounter that causes a pure percept to emerge. (Frichot 2008: 34)

In the current research, 'affect' includes the body as mental image. Moreover, 'affect', as claimed by Massumi, relies 'on the irreducibly bodily and autonomic nature of affect' (Massumi 2002: 28). Massumi continues:

> For affect is synesthetic, implying a participation of the senses in each other: the measure of a living thing's potential interactions is its ability to transform the effects of one sensory mode into those of another. (*Ibid*. 35)

The emergence of synesthetic experiences in the works is the relation between the sonic part produced by the author and the mental imagery perceived by the auditor as architectural and environmental spaces, but also the perception of

one's own body as proprioception.[3]

Although this research focuses on sound works, the relationship with light is interesting in order to apprehend the notion of immaterial architecture. In Eliasson's *The Weather Project*, housed in the Turbine Hall of Tate Modern in London (2003):

> Visitors were sprawled across the ground, transfixed by the looming interior sun and the subtle shifts in light and humidity, as well as their own images reflected back to them from the mirrored ceiling high above. (Frichot 2008: 34)

The work not only transfigures the space (The Tate Modern), but also immerses and *affects* the visitors. These kinds of atmospheric works were also developed for example by the composer La Monte Young with his *Dream House* installed in Tribeca since 1982*,* where light played a role*,* yet he defined also clearly a sonic architecture as claimed by LaBelle:

> …The *Dream House* is formed at the moment an individual enters the sonic field – immersed as in a fluid, sounds oscillate across a range of frequencies through the movement of the body, enfolding the self in a sonic architecture (…) (LaBelle 2006: 73)

The sonic field of the actual portfolio engages the auditor in order possibly to trigger the movement of her/his body into a sonic architecture through deep listening and perceived as mental imagery. However, in reference to Douglas Kahn essays 'Let Me Hear My Body Talk, My Body Talk', the artist and critic Seth Kim-Cohen underlines Kahn's thoughts about the role of the body, percepts and ambience:

> What the body means; the body's role as a producer and/or receiver of signals; the body's status as a component of the subject, as a discrete object, or as an entity that complicates this divide. Following from this, I want to think about how Cage, Turrell, and so many contemporary artists working with sound direct attention toward percepts, toward the sensory conditions of a given time and space. I want to think about how this turn toward a situation's ambience

[3] 'The non-visual systems that contribute to the perception of orientation and movement of the body embrace the vestibular, somatosensory, proprioceptive and auditory systems' (Benson in Warren and Vertheim 2014: 145).

> downplays other situational relations: issues of interiority and exteriority, real versus mediated experience, and how these relations instantiate power in one location, one actor, or another. (Kim-Cohen 2013: 18,19)

In relation to Kim-Cohen's proposal, sound is not approached here as a creator of ambience; rather, it is investigated towards the relationships between sound, space, body, perception, and issues about interiority and exteriority. The latter issues are of particular interest and developed by exploring the *Glass House* of the architect Mies van der Rohe, with the idea of interpenetration of external and internal space as detailed in Section 3.6.1.5.

Each composition has a relation with architecture, and this is introduced for each piece in Chapter Three:

- *The Fall* is a dialogue between a sculpture and a sound installation, where the physical sculpture emerges, from spatial concerns, from a building (the conservatory of Neuchâtel in Switzerland).
- *De Rerum Natura* exists when it interacts with the architecture of the performance space by projecting the sounds into it. The interaction is a significant component of the piece.
- *My Extra Personal Space* relates to the sound of the soundscape of Paris and Normandy, and in particular to the reverberation of the architectural objects and spaces of the city and nature.
- *Kinetism* defines a sonic architecture in the exhibition space by creating a situation where external sounds from the environment and internal sounds of the body are experienced simultaneously by the audience.
- *Music for Brainwaves* is activated by the recording of physiological data from the performer's body. The consecutive sonification of the data is then projected into a resonant architecture in order to create a biofeedback. The result is a hyperbiological space.

- *Voice from the Coalmine* is developed by collecting sounds inside the different shapes of the architectural spaces of a coalmine, and then projected several times into the power plant of the coalmine.

The term *space* derives from the French *espace* and Latin *spatium.* The later, from the point of view of this project, refers to the Greek *chôra* as being the *distance* between objects, sites and places. Casey underlines that:

> '*Chôra*' is 'room' that is filled, not vacant space (*kenon*) (…) Heidegger remarks that the Greeks experienced the spatial on the basis [of] *chôra,* which signifies (…) that which is occupied by what stand there, the place belongs to the thing itself. Each of all the various things has its place. That which becomes is placed in this local 'space' and emerges from it. (Casey 1998*:* 353)

Chôra in the current project relates to the idea of space filled with sound and how it leads to a) a definition of space by (moving) sound and b) a merger defined by the relation of sound and space. Therefore the space is not a vacant space, but it exists because sound defines the space and *vice versa*. Sallis in Boellstorff cites Plato about chôra as 'a mass of wax or other soft material on which the imprint of a seal can be made' (Sallis in Boellstorff 2011: 515). In this sense, the project investigates the space occupied by sound and the kind of imprint, which emerges from such relationship.

Extensive philosophical questions defining the space and how it is perceived are proposed in *The Poetics Of Space* by Gaston Bachelard (Bachelard 1992). The development of Bachelard is based on the poetic representation of space as internally produced by the imagination. Bachelard interprets metaphorically intimate spaces by proposing the house as a symbolic view of the body. Therefore, the study of space within the humanistic perspective is the study of ideas and spatial feelings linked to sensation, perception and conception (Sanguin 1981: 568). Such ideas of sensation, perception, and conception are explored in the actual study by presenting six works to an audience through a survey. The answers are consecutively analysed through methods based on phenomenology as developed in Chapter Two. That is, the development of the

artworks and the related answers from the participants form the methodology of the thesis as a perceptual analysis of an artistic practice. Chapter Two introduces Intention/Perception (abbreviated to In/Pe) as the name of the project developed within the current study as the study of composer intention in relation to listener perception. The analysis, *via* an empirical survey informed by phenomenology, is based on the result of the audience's listening to an original portfolio, which was created as a practice-led methodology. The phenomenological sources are introduced throughout the chapter. The project derives partially from Leigh Landy and Robert Weal Intention/Reception (I/R) model. The model will be explained, and its relevance to the project will be outlined. Chapter Three includes the six pieces of the portfolio and the observation of their contexts and composition. Chapter Four presents the analysis of the perception of the portfolio by the audience. Chapter Five concludes the research by discussing the results of the investigation in relation to the questions through empirical findings, and the future directions of the study.

1.2. Background

The emergence of new technological recording developments in the mid-twentieth century facilitated new opportunities of composition theories and modes of listening for sound and space in sound-based artworks. Edgar Varèse was helped by Pierre Schaeffer with *Déserts* for electroacoustic insertions in his orchestral work in 1954. However, as a starting point for the current research, Varèse developed the idea of projection and organisation of sound masses in space. He was able fully to achieve this in 1958, when he presented *Poème électronique* at the Brussels World Exposition, with technology provided by Philips in the Netherlands:

> In my work one finds, in place of the ancient linear set counterpoint, the movement of planes and sound masses that vary in intensity and density. When those sounds collide, it results in phenomena of penetration or of repulsion. Some transmutations sit on one plane. Projecting them onto other planes would create an auditory impression of prismatic deformation. Here you have, as point of departure, the same process as that found in the classical counterpoint, with the difference that now, instead of notes,

> organised sound masses move against each other.[4] (Charbonier in Mathieu 2004)

The main interests developed in the study relate to Varèse's mentioning of 'the movement of planes and sound masses' and that 'organised sound masses move against each other.' The movement of planes and sound masses entails an integration of space into the process, and thus space becomes a paramount element of composition.

Another important figure for this study is the composer (and '*homme de radio*') Pierre Schaeffer, who first coined the term *sound object* with the information theorist Abraham Moles between 1948 and 1952 (Schaeffer 1952) while conducting research into *musique concrète.* It was further elaborated in his book *Traité des Objets Musicaux* (Schaeffer 1966). The sound object is linked to *reduced listening* as a sound removed from its original context through recording practice. It implies an abstraction of the context of origin and a focus on the sound object, which becomes a self-referential entity.

The opposite of *reduced listening* is *heightened listening,*[5] and a major component of the portfolio presented in the current study refers to larger sections of sound as soundscapes, which include the context. The composer Barry Truax mentions that 'perhaps the biggest obstacle that environmental sound erects to its musical usage is the fact that its meaning is inescapably contextual' (Truax 1996: 52). The research would not be complete without the

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[4] 'Dans mon œuvre on trouve, à la place de l'ancien contrepoint linéaire, fixe, le mouvement de plans et de masses sonores, variant en intensité et en densité. Quand ces sons entrent en collision, il en résulte des phénomènes de pénétration, ou de répulsion. Certaines transmutations prennent place sur un plan. En les projetant sur d'autres plans l'on créerait une impression auditive de déformation prismatique. Ici vous avez encore comme point de départ les mêmes procédés que l'on trouve dans le contrepoint classique, avec cette différence que maintenant, au lieu de notes, des masses organisées de sons se meuvent l'une contre l'autre' (Charbonier in Mathieu 2004).

[5] *Heightened listening* refers to modes of listening, in particular that proposed by Pauline Oliveros as *deep listening.* Thus, *reduced listening* removes the context of the recording and focuses on the *sound object*, whereas *heightened listening* observes each detail of the sound, as proposed by Oliveros:

> With heightened listening ability one can detect the slightest differences in sounds. This enables acute voice recognition, echo detection, spatial location, etc. Such heightened listening substitutes auralization for visualization (or seeing) by creating sonic pictures, etc. (Oliveros 2010: 79).

American composer Pauline Oliveros and the concept she initiated of 'deep listening' (Oliveros 2005). She developed 'a practice that is intended to *heighten* and expand consciousness of sound in as many dimensions of awareness and attentional dynamics as humanly possible' (Oliveros 2005: xxiii). The above-mentioned ideas contributed towards the development of a new dimension in listening, composing, and perceiving sound simply through including the influence of space. The key listening modes (reduced listening, heightened listening and deep listening) are important in the perception of the relation of sound and space, and for the study of the perceived mental imageries related to architectural and environmental space. In the current project they are present as follows:

a) While the author explores and records sounds of a site, those perceived while *deep listening*, and therefore a *heightened listening* is reached. Then, in the studio for composition, the sounds are listened to and considered as *sonic material* and as such they are abstracted. They are removed from their context in the studio in order to become distinct elements of the composition and become, thus, *sound objects de facto*, and this is *reduced listening.*
b) The merger of sound and space is proposed to the *listener* in mental imageries. Thus, *deep listening* of the compositions is paramount in engaging with the architectural and environmental spaces investigated by this research.

In relation to the listening modes and mental imagery, the spaces are categorised as follows:

- **Real space (Tangible/Visible)**

The real spaces are the architectural and environmental spaces visited during the composition process. The interest resides in the acoustic properties of the encounter of sound and space while *deep listening* when recording the sonic material. It leads to a *heightened listening*, which is an auralisation of the visited locations.

- **Virtual space (Imagined/Artificial)**

Virtual spaces are understood here as mental spaces constructed while *deep listening* to the compositions. In this case, it can lead also to *reduced listening*, because the sounds, the spaces and the composition are removed from their context, at the exception of *Music for Brainwaves.* The latter is a performance and thus includes necessarily the context. The majority of the works include virtual space (see Fig. 1.7.3).

- **Hyperbiological (Imagined/Physical)**
  Hyperbiological space is solely related to the composition *Music for Brainwaves* and embraces the idea of a space; it includes biological data (EEG) in the sound and space relation, while deep listening and by perceiving neurofeedback.[6]

The mapping of the three different spaces is detailed in Section 1.4.
Finally, the dichotomy between personal and extra-personal space in the auditory domain is not yet thoroughly understood, and the actual proposal that investigates the intention of a composer in relation to external world sounds and internal perception by the audience might provide insights. Therefore, another essential component of the study observes the audience perception of space, which is 'the affective interpretation of space **-** how the listener experiences and feels about space. This last area is the most neglected (often unconsciously) by the composer.' (Smalley 1996: 90) The perception of space through sound necessarily involves the body, and the notion of embodiment is central. Labelle proposes that:

> Sound and auditory experience forms a primary sensual matter in continual contact with the body. The sonority of daily life is a deeply impressionable sensing, impinging on thought and feeling in ways that give accent to the shifting self. (LaBelle 2010:134)

Therefore, sound and space are linked to vibration and resonating energy within the body that will result in mental imagery of space, since space is embodied through sound and perceived in mental imagery. In order to experience and feel space, the idea of the project is to explore mental imagery through listening. It includes an analysis, as proposed by Gayou:

> Let us recall that tripartition consists of cutting the musical act into three parts: The poïetic which concerns the production of the music, the esthesic, which relates to the work's reception, and the neutral level which is in between the two (…) Pursuing an exploration of the limits of the zone between the poïetic and the esthesic, where the

[6] 'EEG biofeedback, or neurofeedback, is a sophisticated form of biofeedback based on specific aspects of cortical activity. It requires the individual to learn to modify some aspect his / her cortical activity. This may include learning to change the amplitude, frequency and / or coherence of distinct electrophysiological components of one's own brain' (Vernon 2005: 347).

> activity of thinking in images is placed, it seems to us that the route to follow is to develop a code of writing for electroacoustic music. (Gayou 2006: 126, 129)

The poïetic (production) relates here to deep and highlighted listening during field recordings and in studio for production, whereas the aesthesic relates to the hearing/reception of the piece by the audience. Thus, the perception of architectural and environmental space visualised by the participants while listening to the portfolio constitutes the zone between poïetic and aesthesic, and might provide information useful for writing electroacoustic music.

Each piece within the portfolio involves a location (e.g. for field recording, a geographical source; for performance, a 'stage'). Each story includes trajectories that define space in relation to the movements of the author and the movements around him in the field while recording, or to the movement of the sound in the performance space. These trajectories relates to the development of each piece, creates and produces space. Those movements are the interrelation of forces, which are detailed in Chapter Three. Emmerson suggests that:

> Space itself can 'tell a story'. A sense of space, of being and existing (…) space and perspective are now truly materials with which we can compose. (Emmerson 2007: 102)

The portfolio of the current research proposes the stories of the compositions as:

- ***The Fall***

  The fall of a meteorite (trajectory);

- ***De Rerum Natura***

  The outcomes resulting from deep listening in the Amazon rainforest (the trajectories of the sounds of the fauna, and later the projection of those sounds in the performance space);

- ***My Extra Personal Space***

  The stories (as soundscapes) generated by the activity of the city, e.g. the itineraries and trajectories of people and the vehicles in contrast to the activity generated by the rural environment, e.g. the trajectories of the birds, the movement of the sea, the wind.
- ***Kinetism***

  Stories linked to out of body experiences that generated the idea of the sound installation (the encounter of environmental sounds and bodily sounds);
- ***Music for Brainwaves***

  The stories of EEG activity, in the mind of the performer, sonified and projected into the performance space, and in particular the ex-NSA listening station, where stories of people might still reflects in the spherical radome where the antennas were.
- ***Voices from the Coalmine***

  The stories are linked to the past activity of the coalmine and the resonating voices of the workers emerging from it, layered with the stories from an autistic person explaining her experience of the perception of the world.

Therefore, the pivotal elements relate to how the author and sound move within a space, the modes of listening, the types of spaces in which sound develops, the product of the interrelation of forces, how the audience perceives space, and which kind of story a space can tell in relation to an author intention.

1.3. Influential Artworks on Sound and Space

The relation of sound and space in composition and how the perception of the audience is influenced are proposed below through artworks of Maryanne Amacher, Max Neuhaus, and Alvin Lucier.

Maryanne Amacher's influence on the project is important, since her work proposes an emphasis on how to affect the audience. The idea includes the

notion of site-specificity, where the psychoacoustic illusions are determined by the acoustics of the architecture, as underlined by Stein:

> Amacher designs sound pieces for specific architectural and natural localities, calculating resonant properties of the ambient materials, fitting sound to resonating space, overwhelming the internal 'mental' properties of musical sound so that sound and mind (or this way my extrapolation) threaten to go to war. (Stein 1999: 156)

Amacher's *City Lights* series as described by LaBelle's 'consisting of installing microphones at given locations and feeding these sounds to another distant location to create "synchronicities" of different places. This idea reveals the concept of field spatialisation, where distant and close sounds are re-unified in a single location' (LaBelle 2006: 170-172). The idea of field spatialisation is recurrent in the actual portfolio; meaning that several spaces and places are deterritorialised from their original locations and reterritorialised in the composition, the place of performance, the exhibition, and even in the personal 'mental' space of the listener. Amacher presented a performance on 27 May 1977 at the Kitchen in New York, where she played with several loudspeakers hidden behind walls or in closets in a manner that made it impossible to locate the sound. Here, the notion is about the modification of the perception or disorientation, according to Johnson:

> She must have spent hours testing the acoustics, fiddling with levels, moving loudspeakers around, and such things, because as she mixed it all together for the audience, magical things happened, and most of the magic was not on the tape itself but in the playback technique. I never did figure out exactly where the loudspeakers were. Apparently they were tucked away in closets and adjacent rooms in very special ways. It was difficult to tell exactly where any of the music was coming from, and yet each sound took on a particular spatial characteristic. (Johnson 1989: 171)

The experience described by Johnson relates to the reflections of sound in space, and contributes to the realisation one has of multiple physical and personal spaces in the above-mentioned performance. These are:

- The performance space;

- The space created by reflections behind the walls or/and in the closets;
- The space created by reflections of sound in the performance space;
- The resultant space (emerging from those above) perceived by the audience while walking in the performance space, and
- The perceived 'mental' space of the audience.

The above combination of *layers* of space, somehow linked to each other, instigate the ecology of sound, space, and perception. Those spaces define new environments, social relationships, and human subjectivity, referring to the proposal of Guattari:

> An ethno-political articulation, that I called ecosophy, between the three ecological registers, the one of the environment, the one of the social relationships and the one of the human subjectivity. (Guattari 1989: 12)

Guattari's proposal, included in the three registers as an ecological context, is developed in the current project as a) an *environment*, where sound and space relationships lead to a merger, which is observed as b) *social relationships* between the composer (intention) and the auditor (perception). It includes to some extent situations where the composer is also the auditor, and c) *human subjectivity* as the result of the perception of the portfolio leading to mental imageries:

a) *Environment*

   The merger emerging from the relationship between sound and space is the result of an ecological system, where energies of the sound are deployed into an architectural space, resulting in interrelationships, and leading to a vibrational environment defined by the movement of sound masses;

b) *Social Relationships*

   The social relationship relates to how the portfolio developed by the composer as an *intention*, including movement into spaces while field recording, leads to *perception* by the audience. Thus, how the

portfolio *affects* the audience.

c) *Human subjectivity*

The relation between the external world and the internal perception are not detached from one another, but is the movement of the body into the environment that creates an internal perception. *A fortiori,* the intersubjective perception between the author (*Intention*), who is the explorer of spaces, and the internal *perception* of the audience as architectural and environmental space, is the human subjectivity. The latter issues are proposed through the metaphor theory (Lakoff and Johnson 1980) by the cognitive linguist George Lakoff and philosopher Mark Johnson, and are summarised by Clarke as follows:

1. The primary way in which we know and 'have a world' for ourselves is through the body.
2. Sensory-motor engagement with the world generates, and is in turn mediated by, schemata – patterns of action, perception and conception that 'emerge as meaningful structures for us chiefly at the level of our bodily movement through space, our manipulation of objects, and our perceptual interactions' (Johnson 1987: 29).
3. Building upon this developmentally fundamental embodied experience, all of our knowledge and understanding are conceived in terms of generalisations based upon, and extensions of, that primary contact.
4. The generalisations and extensions are conceptual metaphors, not because they necessarily have a linguistic component (although many do), but because they all involve a mapping of properties from a source domain onto a target domain: 'A metaphor in this ''experiential'' sense, is a process by which we understand and structure one domain of experience in terms of another domain *of a different kind'*. (Johnson 1987: 15; original emphasis)
5. The primary and overwhelmingly prevalent source domain, for almost every target domain that we encounter, is bodily experience: experience is deeply and pervasively embodied. (Clarke in Born 2013: 103)

The metaphor relies in the current project on a language between sound and space, developed through the experience of spaces by the author, and the experience of the works by the audience. Such experience is *mediated* through embodiment.

The idea of space shaped and blurred by sound (and *vice versa*) stipulates that the two are intrinsically linked. The listener perceives the result (the merger) as a new relation to architecture (and even as a form of architecture *per se*). The movements and projections of the sound masses in the *sonic* space lead to the existence of the space, a space perceived through listening. The sound diffused into the *architectural* space, too, is shaped by it, meaning that the reverberant properties of the space *affect* the sound. According to LaBelle:

> Architecture especially articulates sonic imaging in ‘structure-borne’ sound, magnifying colour and spatial presence as the sound shapes interact with structural characteristics of the rooms before reaching the listener. (LaBelle 2006: 172)

The artist and musician Max Neuhaus advocated the idea of sound placed in space, and the radical idea to define space with sound, through the term he defined as *sound installations*. The radicality resides in the idea to move sound from time domain to space domain:

> Utilizing his sense of sound and people's reactions to it gained after fourteen years as a musician, he began to make sound works which were neither music nor events and coined the term 'sound installation' to describe them. In these works without beginning or end, the sounds were placed in space rather than in time. Starting from the premise that our sense of place depends on what we hear, as well as on what we see, he utilized a given social and aural context as a foundation to build a new perception of place with sound. (Soundworks 1994: 1)

The aural context is a major concern, since it allows the perception of space beyond vision, and thus defines a personal reality for each auditor.

Neuhaus saw himself as a sound sculptor, which implies the potential to build a space from sound, where sound is a material ready to be sculpted. In that respect, Max Neuhaus in an interview with Duckworth mentions that:

> In terms of classification, I'd move the installations into the purview of the visual arts even though they have no visual component, because the visual arts, in a plastic sense, have dealt with space. Sculptors define and transform spaces; I create, transform, and change spaces by adding sound. The spatial concept is one which music doesn't include. (Duckworth in Neuhaus 1994)

This definition of the transformation of space by adding sound reaches the core of the current research, as magnified by Neuhaus, which is, as for the visual arts, in a plastic and sculptural sense. Then, sound modifies space and *vice versa* by the reverberant (of the space) and the vibrational (of the sound) properties. The merger, the sonic space, is not visible and appears through deep listening. The perception is necessarily internal, mental, personal, and subjective. The same idea exists within a classic composition like *I am Sitting in a Room* by Alvin Lucier, where space affects, shapes and resonates within the composition, as mentioned by Chadabe:

> The signal goes through the air again and again (…) the space acts as a filter; it filters out all of the frequencies except for the resonant ones. (Chadabe 1997: 75-76)

The work of Alvin Lucier is a major reference for the current research. In particular, *Voice from the Coalmine* was influenced by *I am Sitting in a Room* and *Music for Brainwaves* by *Music for Solo Performer*. The influence lies mainly in his approach, which is strategically to organise the relationships between sound and space. This can be found in his composition *Chambers,* proposed as follows:

> Collect or make large and small resonant environments (…) Sea Shells, Rooms, Cisterns, Tunnels (…) Sounds of the outer environment encompassed by the players may be heard with reference to the sounds of the portable resonant environments carried by the players. (Lucier 1995: 298)

The relationships between the sounds of the outer environments and the portable resonant environments are a key idea for the present research, in the exploration of a merger between sound and space. The merger emerges from the encounter of many resonant spaces reunified at a single location, this being the exhibition or performance space. The natural properties of sound are of particular interest:

> Sounds have specific spatial characteristics. Those of short wave length (high frequencies) are directional; longer ones (low) spread out (…) Each space, furthermore, has its own personality that tends to modify, position, and move sounds by means of absorptions, reflections, attenuations, and other structurally related phenomena (…) Accepted as natural occurrences to be enjoyed and used, however, they open up a whole new field of musical composition. (*Ibid:* 416)

These occurrences are used in the portfolio as strategies, in terms of composition. Space is observed in the current research as a material merging with sound and *vice versa* through multiple acoustic strategies. For Maryanne Amacher, Max Neuhaus, and Alvin Lucier, the main influences for the development of the portfolio, the role of space in their compositions is crucial to delivering a novel perception of an existing space.

1.4. Mapping and Definition of the Spaces

The development of the portfolio as practice-led research is observed through the mapping of three types of spaces, i.e. a contextualisation of the notion of space through typologies, which delineate an area of spatial investigation, as proposed in Figure 1.7.3. The artworks are proposed in the following categories:

- Real spaces (architectural, natural, abandoned);
- Virtual spaces (immaterial architectures built by the self and subjectivity, which are constructed spaces), and
- Hyperbiological spaces (biofeedback responding to environments and included in a process of man-/computer-networked space).

The goal of the project is to explore whether space and sound are intrinsically related when they are combined, and how sound objects (from an acoustic point

of view) reflect and amplify the notion of the resonant properties of the space. Hence, the sound object is explored with the terminology of *heightened listening*: not as opposed to the *reduced listening*, but as a metaphorical vision of sound, where the sound object is a soundscape, layers of space are superimposed, and which include the notion of deep listening. Thus the sound shifts from a sound object to a broader notion of sound as space. On the one hand, the categorised spaces for the compositional process operate as amplifiers with their intrinsic aural potentialities. On the other hand, the spaces are investigated as case studies for performance and exhibition in a dynamic relationship between the listener and the composer, reflecting Kahn's comments on body and space:

> Young's Composition 1960 *#7* at the same time makes possible music and acoustic works based upon new elaborations of space and the body (factors also repressed within the traditions of Western art music). Although Young and a few other composers and artists have continued to pursue this area, it remains largely unexplored. (Kahn in Kelly 2011: 40)

In the following categorisation of spaces, the portfolio plays a great role in the exploration of the merger of sound and space. Space and body as proposed by Kahn in Kelly are two main components in the investigation of the mergers.

1.4.1. Real Space

A real space context is the aural reflection of an architectural space or the sonic potential of an environment (a site of sound) which receives the work and where the work is developed. Therefore, the study observes the sonic material recorded in architectures and environments. Then, it observes how sound objects are transformed when diluted, shaped, confronted or associated within one or more spaces.

1.4.2. Virtual Space

In sharp contrast to a common definition of virtual space that reflects networked digital environments (which appeared originally in the book *Neuromancer* by

William Gibson) yet called cyberspace (Gibson 1984), the virtual space explored in the current project relates to Antonin Artaud's ideas on alchemy, virtuality, and theatre:

> This perpetual allusion to the materials and the principle of the theatre found in almost all alchemical books should be understood as the expression of an identity (of which alchemists are extremely aware) existing between the world in which the characters, objects, images, and in a general way all that constitutes the virtual reality of the theatre develops, and the purely fictitious and illusory world in which the symbols of alchemy are evolved. (Artaud 1958: 49)

The virtual space therefore resides in the mind of the participant subjectively through, for example, the invitation, in the current portfolio, to take a stroll in a sound installation and to explore the perception of the related experience, which should lead to a personal virtual space.

1.4.3. Hyperbiological Space

The relationship between the performer/machine computer network delineates the hyperbiological space, where physiological data (such as an EEG or conductivity), processed by computer, are determined and sent as sonic information to the performance space where it is, in turn, received and processed by the performer. The performer's reception of the sound closes the loop, causing the corresponding modulation of physiology known as neurofeedback.

1.5. Aims, Objectives and Personal Motivations

The aim of the project is to reach a greater understanding of the interrelationship of organised sound, space and perception, in order to develop a spatial language of sound. This is achieved by an analysis of the area lying between composition strategies and the audiences' perception of works of sonic arts. Therefore, the research includes a portfolio of artistic works as well as scholarly research. The two parts inform each other. The creative works consist of electroacoustic compositions, sound installations, and performances that

explore how sound influences space and *vice versa*. The written work consists of the theoretical presentation of the key subject and includes analysis supporting the production process of the portfolio works.
The perception, in the mental imagery of the audience of the different compositions of the portfolio, is investigated by way of a survey informed by phenomenology. How does the listener experience and feel about space, be it real, virtual or hyperbiological? What kind of architectural and environmental space is perceived?

1.5.1. Definition of the Aims

- To question the relations between sound and space, including the investigation of embodiment, experience, and perception of the listener in this relationship. This is discussed in Sections 1.7, 1.8 and 1.9 of the present Chapter and also in Chapters Three and Four;
- To investigate the layering and the merging of multiple spaces as a tool for the development of perception and creation within the sonic arts. This is presented in all of the works presented in Chapter Three;

> There is also, in both film and music, the possibility of what we might call a vertical montage.[7] The composer can offer superimposed layers of sonic transformation while appearing to preserve the temporal duration of a real-world scenario. Instead of slavishly following a composer-directed narrative, we create an inwardly perceived dynamic as our listening re-perception travels to and from. (Norman 1996: 10)

One inwardly dynamic perception is developed by layering and merging multiple sound and space relationships as a vertical compositional tool; another consists of the superimposed layers of sonic transformation as proposed by Norman, which permit the development of a strategy that aims to increase the internal perception of a work. It achieves this by shifting between the real space and the virtual (internal space imagined

[7] Not to be confused with Eisenstein's specific use of this term to describe the relationship between sound and image in film.

and therefore artificial) created by the layering.

- To explore the artistic potential of sonic properties emanating from buildings, landscapes, natural areas, and abandoned sites. This is addressed in Sections 3.2, 3.3 and 3.5 of Chapter Three;

1.5.2. Definition of the Objectives

- To create a portfolio of original works, one which observes the dynamic relations between sound and space, in terms of aesthetics, perceptions, listening modes, and experience. This is presented in Chapter Three;
- To define progressive strategies between the listener and the performer in the space of the performance and exhibition in order to understand how the audience perceives the intentions of the composer in the context of space and sound. This is discussed in Chapter Four;
- To define a plastic (from the visual arts) approach with regard to sonic arts. This is presented in Section 3.1 of Chapter Three and also in Chapter Four;
- To integrate biological data (EEG) into the sound/space quest in order to promote and develop a new generation of original works and therefore observe the embodiment of sound. This is presented in Section 3.5 of Chapter Three.

1.5.3. Definition of Motivations

The interest relates to my background in architecture, composition, sound installation, performance, and neuroscience. The idea is an investigation of a sound and space practice that develops a language based on the mental imagery of perception. In this quest the observation is based not solely on the interpretation of the audience, but includes the process of development from the composer to foster the link between *intention* and *perception*. Consequently, it contributes to establishing the foundations of research based firstly, on sound and space as materials to shape, and secondly, for the interpretation of the mental mechanisms of listening and mental interpretation.

1.6. Research Questions

- What is the relation between sound and space in the sonic arts, and to what kind of merger does it lead?
- What relationship exists between the intention of the composer and the perception of the audience regarding architectural and environmental spaces?
- Is there a common thread of perception of architectural and environmental spaces among participants?

  Is embodiment a key for the perception of the dynamic relations of sound and space?

1.7. How does the Portfolio Support the Research?

The portfolio contains six artworks that investigate the categorisation of space as defined by the map of the research. Each piece explores defined aspects of one or more categories of space. The pieces are then proposed to an audience for a single listening session; the first impression is analysed through a survey based on phenomenology.

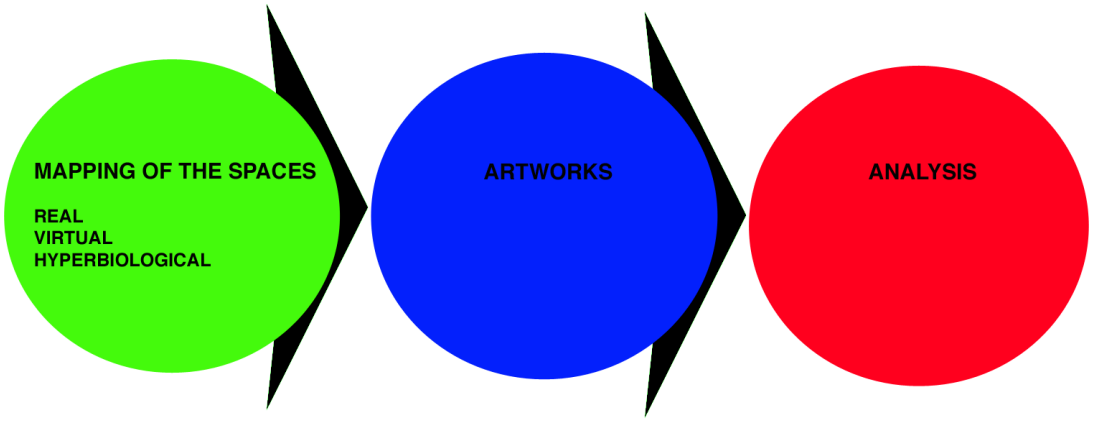

Fig. 1.7.1 Research Process

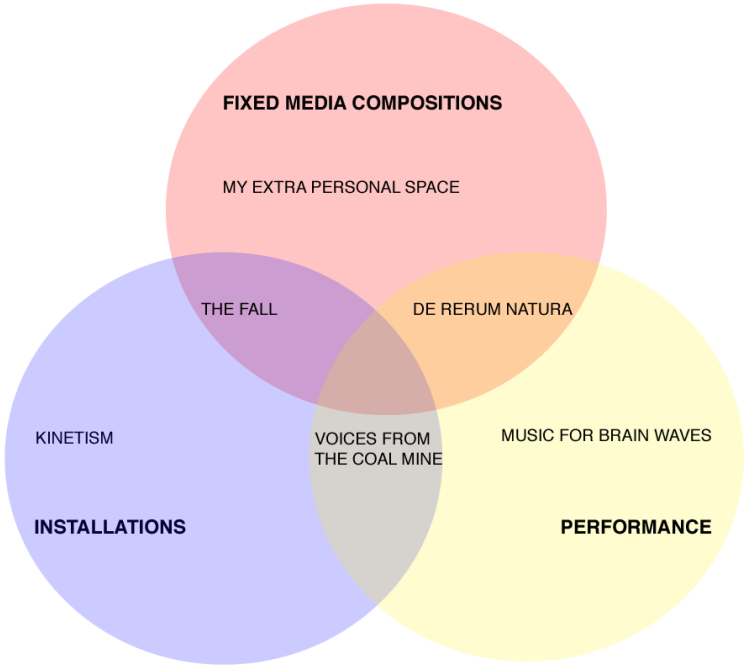

Fig. 1.7.2 Categorisation of Disciplines

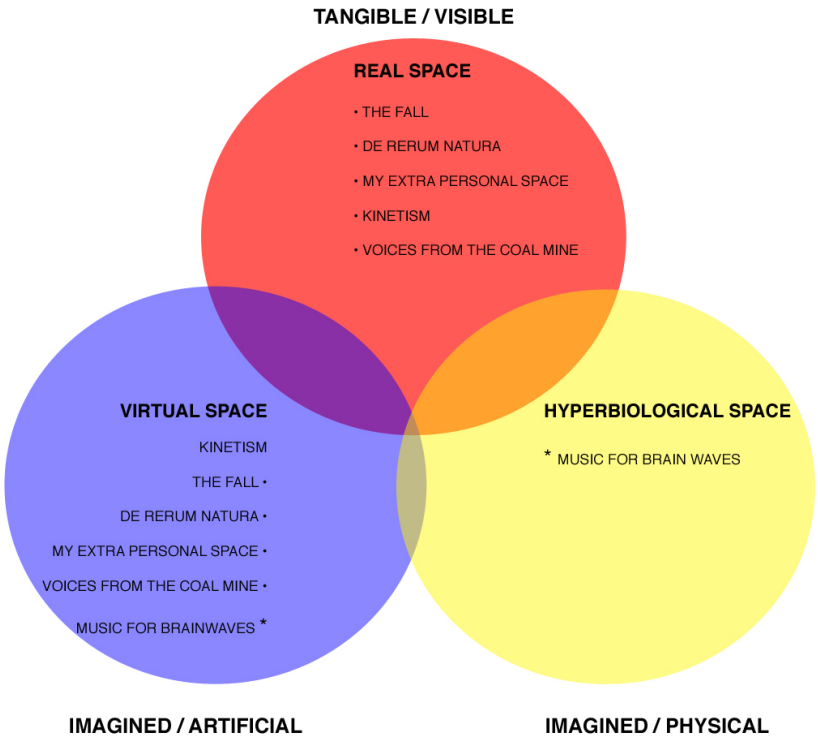

Fig. 1.7.3 Map of the Spaces

1.8. Documenting Site-specific and Ephemeral Processes

The documentation of site-specific and ephemeral processes is crucial for the actual development of the artworks. In the current study, the process is observed through the write-up (theoretical) and the documentation (practice) included within the actual project. Although the recording of a sound artwork does not provide the original experience defined by the author, it nevertheless informs the auditor of the *nature* of the artwork. Of course, the recording can also lead to misinterpretation, since the experience has to be *perceived* through the body, and thus a recording, a photography or a video are merely artefacts and do not constitute the artworks. The importance of the writings is that they underscore the intention of the author, also because sound and space are immaterial and invisible. As an example, Salomé Voegelin, an artist and writer, proposes works that were presented as 'photographs' instead of the original piece:

> '*12 + 1 =*', an installation from 1976, in which Gervais played 13 vinyl records on 13 gramophones, simultaneously. It was also part of the 2011 retrospective (…) at the Leonard and Bina Ellen Art Gallery in Montreal. There, however, the installation was not 're-created'. It was soundlessly represented by this photograph, made by Roland Poulin (…) It will be impossible to 'know' (to experience) these works. It will only be possible to 'know about' them, via the available documentation (…) In such cases, as some argue, it is the collected (or selected) documentation that *becomes* the work. (Voegelin 2013)

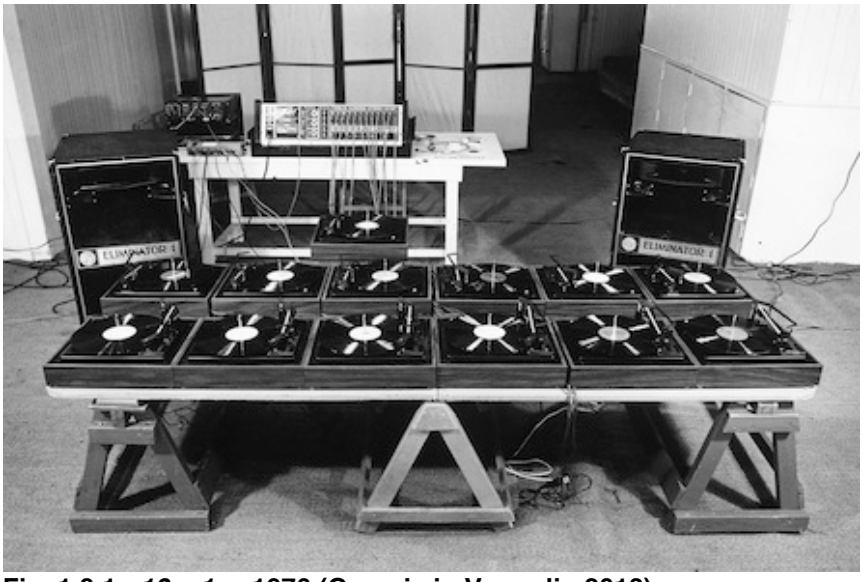

Fig. 1.8.1. ***12 + 1 =,*** **1976 (Gervais in Voegelin 2013)**

In contrast, when documenting pieces like *The Fall*, *De Rerum Natura, Voices from the Coalmine*, *Kinetism* and *Music for Brainwaves,* where the experience of the artwork *is* the artwork, the location where it is held is a major component, thus it can be possible to experience it only where and when a performance or exhibition is actually taking place. The documentation aims to transfer to the audience the *sense* of such experience, but it is not the work.

In terms of sound as a material, Rolf Julius is an important artist. Here follow two examples where sound is explored in relation to space through material, and leading to sound *as* material:

- ***Music for a Frozen Lake***

Fig.1.8.2 Music for a Frozen Lake, 1982, Mixed Media, Variable Size (Julius)

> This sound installation comprises audio speakers disposed on the banks of a river. When during the winter the river freezes, the speakers are reactivated. The sound, which is locked in the ice, creates cavities, and very slowly melts the ice. This is Rolf Julius' first artwork that uses the energy of sound as power source. This installation lasted for several weeks. (Julius n.d.)

The sound in this piece is a material that is transformed by the melting of the ice, as if metaphorically it were melting together with the ice and thus gaining a kind of plasticity.

- ***Corner Piece, Dirt***

Fig. 1.8.3 Corner Piece, Dirt, 1983, Mixed Media, Variable size, PS1 New-York (Julius)

Nichols introduces the work of German artist Rolf Julius as follows:

> They are described as combining optical elements with acoustic elements, as engaging with architectural situations, as investigating the potential of silence and so on (…) Might it be possible, in thinking of sound as just another material (…) This gesture is captured by the ubiquitous containers of metal or ceramics – or in other works soft materials such as plastic or paper bags – which gently hold their contents, as we see in the woks filled with grey-brown dirt, for example, or the bowls filled with water given its colour and consistency by dishwashing liquid. (Nichols 2007: 5, 6)

In Julius' work, the combination of the material (e.g. plastic or paper bags, dirt or liquid) and the immaterial (sound and space) lead to a synaesthetic experience that reveals sound as a material. The last idea is of importance, since sound will be approached in the portfolio as material. In the current research, there is no combination of material and non-material, but only sound proposed as material through its plasticity, when projected within a space. In *The Fall,* introduced in the next section (Section 1.9.1.), a discussion with a sculptor will lay the foundation for using sound as a material; this also occurs in *Voices from the Coalmine* and *Kinetism,* which are sound installations. However, in particular for the *My Extra Personal Space* and *De Rerum Natura*, such issues are developed by the composer when a) soundwalking and collecting the material, b) when composing in studio, and c) when projecting the sound masses into the performance

spaces.

1.9. Portfolio

The six pieces of the portfolio belong to one or more categories of spaces and disciplines introduced by the diagrams in Section 1.7. The observation of the relation and the perception of sound and space in the portfolio are present as follows:

- (Deep) listening of sounds and spaces;
- Deterritorialisation and reterritorialisation of sound and space;
- Plasticity of sound as a relation to visual arts;
- Embodiment of sound and space;
- Mental Imageries of sound and space.

In addition, the technique of convolution is explored in order to blend sounds and spaces. Convolution is used in in *The Fall*, and in *De Rerum Natura,* in order to take the impulse of one space and for this to be applied to another; in this case, it is done by synthesis technique *via* software. To a certain extent *Voices from the Coalmine* and *My Extra Personal Space* include convolution, achieved by layering sound and space, and *de facto*, when layering the spaces the properties of one space appear within another.

1.9.1. *The Fall*

The Fall is an eight-channel piece exploring the plasticity of sound, as a sculpture, and conceived to resonate with a physical sculpture as a sonic counterpoint. The piece is also played elsewhere as a concert piece. *The Fall* questions the relationship between the soundscape, the space and the place, and their intrinsic sonic properties. Convolution is explored in order to convey and integrate different families of sound[8] together:

[8] 'Families of sound' relates to my idea of sounds that may have common characteristics (such as timbre, density, etc.) and that might 'work' together as if a chord.

> Convolution is traditionally used to place a dry recording within a reverberant space by convolving it with the impulse response of that space. (Roads in Truax 2012: 197)

Is the plastic and spatial language of a sculpture transferable to sonic artworks? How is it possible to magnify the identity of the location with convoluted sounds? Are the spatial characteristics of the place perceived when played as a stand-alone fixed media piece in a concert situation? Truax proposes the following to document the process of composition and listening issues of these questions:

> The progression from phonographic documentation to a more abstracted approach to ultimately a virtual synthetic soundscape is one that takes the listener from the surface level of an environment, recognising its sound sources and ambiences, to the mental world of psychological and cultural associations, memories and symbolism provoked by those sounds, and then to the unbounded world of imagination. (*Ibid:* 200)

Therefore, the shift from real-world sound to the virtual synthetic soundscape allows the composition to be balanced, and provides additional layers of perception in the imagination of the auditor in relation to the sculpture.

The piece has already been presented at:

- Studio Panaroma / University State of São Paulo / Brazil / October 2012
- Nova Music Festival / Dundalk / Ireland / April 2012
- Alhambra Theatre / Geneva / Switzerland / June 2010
- New Conservatory Opening / Neuchâtel / Switzerland / May 2009.

1.9.2. *De Rerum Natura*

De Rerum Natura is an electroacoustic composition based on field recordings from the Brazilian Amazon forest. The piece investigates the method of deep listening as the main compositional tool. The goal is to create a dynamic subjective link between the listening/recording experience of the original

material and its perception by the audience during the performance. The composition is based on the live projection of slightly manipulated soundscapes from the Brazilian Amazon rainforest. The sound is recontextualised into a performance space. Multiple layers of typologies of spaces are blended for the realisation of an artificial space (e.g. the combination of underwater recordings of dolphins with those of bats). Sonic properties of field recordings are re-projected in the performance place. The position of the listener in the performance space (lying down, sitting, or walking) is encouraged so that the audience may perceive different aspects of the piece and different properties of the space by embodiment.

The piece has already been presented at:

- National Museum of 21st-century Arts / Rome / November 2014
- House for Electronic Arts / Basel / Switzerland / October 2012
- 696 live Concert Venue / Shanghai / China / April 2012
- DeutschlandKultur Radio / Berlin / Germany / October 2011
- Fünf Gallery / Berlin / Germany / October 2011
- BM Space / Shanghai / China / July 2011
- The Lab Gallery / San Francisco / USA / May 2011
- UB Radio Salon #174 / San Francisco / USA / May 2011
- Dem Passwords Gallery / Los Angeles / USA / May 2011
- Swiss National Radio La Première / Lausanne / Switzerland / April 2010
- Museum of Fine Arts / La Chaux-de-Fonds / Switzerland / November 2009
- Festival of Performance / Teatro Galpao / Belo Horizonte / Brazil / October 2009
- Festival Nuit Bleue / Arc et Senans / France / May 2009.

1.9.3. *My Extra Personal Space*

The soundscapes, the spaces of the city of Paris and the coastal town of Etretat on the Normandy coast in France, are recorded as a Baudelarian drift. A 'drift' refers to the poet Charles Baudelaire's *flâneur*:

> The concept of the *flâneur*, the casual wanderer, observer and reporter of street-life in the modern city, was first explored, at length, in the writings of Baudelaire. Baudelaire's *flâneur*, an aesthete and dandy, wandered the streets and arcades of nineteenth-century Paris looking at and listening to the kaleidoscopic manifestations of the life of a modern city. (Seal 2013)

The project is an exploratory soundwalk into an urban and a natural environment. For the audience (perception), the idea (intention) suggests daily urban sounds confronted with or blurred by natural sounds (and *vice versa*) and magnified as an imaginary stroll. The aim is not the confrontation of lo-fi *vs*. hi-fi sounds; rather, it is the possibility to combine both environments. The sounds and spaces collected are recombined to design metaspaces[9] through the addition of similar timbres and families of sounds observed at macro- and micro-levels. Pape suggests the idea through Nono's approach to sound, space, and the related listening issues:

> His search for the mobile especially, his explorations with micro-tonality within the sound, and his sensitivity to composing in the multi-directional, multi-listening possibility of acoustic space, his curiosity about the nature of sound itself, especially what happens to sound at the extremes of listening, very loud sounds or near silent sounds, the perceptual relations between dynamics, time, space, timbre, etc. (Pape 1999: 65)

The investigation proposes the possibility that the relation of sound and space may be embodied and memorised during field recording and sound walking, transmitted as a composition, and felt by the audience.

The piece has already been presented at:

[9] 'Metaspace' indicates an addition of recorded spaces recombined as artificial ones.

- International Symposium Border Sounds / Freiburg / Germany / March 2014
- TU University / Electronic Music *Studio* / Berlin / Germany / January 2014.

1.9.4. *Voices from the Coalmine*

Voices from the Coalmine is a *sculpture* as a sound installation positioned in a space. The *architecture* is the environment where the work has been set. The *music* is the process of recording, compositing, and performing. The *spatial music* is the process of playing the sound in the former power plant, a coalmine, where recordings of several generations have been set. The idea can be extended to sound and space relation in specific context (e.g. the coalmine). This relates mainly to the idea of sound sculpture and sound installation.
The idea of sculpture relates to Max Neuhaus' approach of removing sound from time, and setting it, instead, in place, as proposed by the curator Ulrich Loock:

> Neuhaus describes a change of paradigm in formulating a notion that is fundamental to his *Sound Works* – 'that of removing sound from time, and setting it, instead, in place'. This change of paradigm makes it obvious to think of sculpture as the point of reference for his work, for sculpture is the medium of an artistic practice that creates the conditions for the specific perception of place (…) His use of sound, then, does inform an operation in the expanded field of sculpture that is not bound to a visual or tangible object. This way he upholds the *Sound Work*'s claim to the primacy of an authentic experience of space. (Loock 2005: 1, 4)

In *Voices from the Coalmine,* the sculptural aspect is created by recording sounds in several spaces of the coalmine, and then projecting them over and over to blend sound and space as a result of generations of recordings, leading to a specific perception of place and therefore an experience of space.

1.9.5. *Kinetism*

Kinetism relates to the original map of space by a means of virtual space. The present work explores virtual space by means of the body and subjectivity: it is the internal space *vs*. external space perception of the body. The participant explores and encounters the zones of convergence by walking into the installation. The convergence of these two paradigms (sounds of the city and bodily sounds) creates temporary zones of perception, which are perceived by one's own subjectivity and are actually the virtual space defined by *Kinetism* (these always differ for each person and time). *Kinetism* explores the perception of our daily sound spaces. *Kinetism* invites the audience to take a sonic walk, where people might realise the dialectic between the internal and the external perceptions of space through sound: one's own body's sound (internal auditory space), which is mostly unconscious, is balanced against the sounds of the city (external auditory space). At Section 3.4.2.2. the neuroscientist Prof. Olaf Blanke mentions that we currently do not know much about the dichotomy between personal and extra-personal space in the auditory domain. Moreover, our personal auditory space seems more complex than its visual counterpart and consists of an external auditory space (skin contact, footsteps) and an internal auditory space (heartbeat, stomach contractions). These internal and external dialogues open a channel to zones of the indiscernible as these are defined by sound. The installation *Kinetism* questions the fact that perceived and imagined spaces are constructed *via* our sensory systems such as the auditory, the visual, and somatosensory, as well as the motor system in the human brain. The installation explores the frontiers of the perception of the body (proprioception) perceived in space through sound.

The piece has already been presented at:

- Exhibition Corps Sonore / Faculty of Architecture / Swiss Institute of Technology / Lausanne / Switzerland / October 2009.

1.9.6. *Music for Brainwaves*

The piece relates to hyperbiological space through the conceptual idea of sound and biological data, sent in space, creating a virtual space and a non-material architecture. This is developed through a procedure involving neurofeedback in a process between a) a performer, b) a computer, and c) a resonant space. This work is inspired by the Alvin Lucier's composition *Music for Solo Performer*. The project focuses on affordable available Brain Computer Interfaces (BCI). Through music technology, appropriate devices, and programming, the brain signals (captured on an EEG machine) offer perspectives for music composition and neurofeedback. The space created here is the relationship between the stimulus (which is part of the composition), the data from the brain, and the transcription of data into a resultant sound. Although much research has been done into music created through EEG, little has been done to investigate the potential relation between space, sound, and biological data such as through an EEG, not only from the perspective of neurofeedback, but actually as a potential virtual perceived space. The central focus is to improve the perception of the hyperbiological space by coupling it to deep listening and neurofeedback.

The piece has already been presented at:

- Theatre ABC / La Chaux-De-Fonds / Switzerland / October 2014
- Teufelsberg Ex–NSA Listening Station / Berlin / Germany / May 2014
- Department of Fine Arts / University of the State of São Paulo / October 2012
- Barbara and Art Culver Centre of the Arts / Riverside / California / May 2011.

The pieces belong to one or more categories of spaces and one or more discipline categories (e.g. composition, sound installation, and performance) according to the diagrams presented in Section 1.7.

Chapter Two

METHODOLOGY AND RELATED RESEARCH

I believe that the artist doesn't know what he does. I attach even more importance to the spectator than to the artist – Marcel Duchamp

A real work of art destroys, in the consciousness of the receiver, the separation between himself and the artist – Leo Tolstoy

Summary

The Intention/Perception (In/Pe) project is the name of the analysis in the current research, *via* an empirical survey informed by phenomenology, of the result of a practice-led methodology leading to a portfolio. The practice-led methodology investigates how the portfolio develops as a process, such as through long-term residencies at research centres, art residencies, universities, fieldwork, and interviews with artists and composers; also, how this methodology informs the artworks. The analysis, through a questionnaire, informs the Intention/Perception link emerging from the *audience's empathy*[10] *with space perception.* The idea is to explore whether and how the audience develops empathy toward the experience of the space explored by the composer.

2.1. The Intention/Perception (In/Pe) Project

The aim of the project is to explore through a questionnaire architectural spaces and environments perceived within an audience's mental imageries, and how the participants to the survey are aware of their bodies in relation to the environment as investigated by the American philosopher Shaun Gallagher (Gallagher 2007: 302). In this context, the idea of *chôra* as a receptacle, not a void, in mental imagery, views Rickert's proposal as:

> A locatory matrix *for* things' (…) Chōra includes emotions,

[10] *Empathy* is the capacity to share or recognise emotions experienced by another sentient or fictional being.

> sensations, and other marks and traces of psychical and material experience. (Rickert 2007: 259, 260, 261)

The concept of chôra is included in the In/Pe project as architectural and environmental spaces produced in mental imagery, including indeed emotions, sensations, and other marks and traces of psychic and material experience. That is, the participants are exposed to a dedicated listening to the portfolio of the current research project and invited to visualise architectural and environmental spaces.

In the present Section 2.1, key concepts that emanate from phenomenology are introduced to contextualise the survey, such as intersubjectivity by Shaun Gallager (Gallagher 2007: 298) and externally and internally directed cognition by Dixon *et al*. (2014), as well as the body as a generative interface between the experience of space and the conceptual thought by Woelert (2011), the concept-like production of space by Lefebvre, and the ecological contexts in which the experience of space happens as proposed by Gaver (1993) and Gibson (1979). In Section 2.2, the methodologies, such as practice-led and qualitative phenomenological inquiry, are developed, as are how they inform each other, and why a particular combination might be beneficial for art-based investigation. The sources for phenomenology emerge mainly from Husserl (1931), Merleau-Ponty (1963), and Leavy (2014) for consciousness and experience, and from Varela (1991) as regards his views on embodiment and enaction. Moreover, the procedures related to the actual research with both methodologies are introduced. The hypothesis of the research is presented in relation to the methodology. In Section 2.3, some background to the research that inspired the current piece is provided, in particular through the project Intention/Reception (I/R) by Leigh Landy and Rob Weale.

The five pieces (the piece *Voices from the Coal Mine* is not analysed because of its unique site-specific nature) propose contrasted thematic and contexts of composition (*Intention*). The framed *Perception* of the audience is sought in the exploration of the dynamic relations and combinations of sounds and spaces;

that is, how sound objects[11] (from an acoustic point of view) intrinsically reflect and amplify the resonant properties of the space, and how the resulting *phenomenon* is perceived. The respective context in which the artworks are presented provide a heightened listening, meaning that audience is encouraged to concentrate while listening on the perceived spatial images. Thus, if the listener develops a mental imagery of architectural spaces and environments, then it may be anticipated that the resulting representation includes, too, the self of the listener.

The sources for the research emanate from ideas such as intersubjectivity[12] (Gallagher 2008) and externally and internally directed cognition[13] (Dixon *et al.* 2014). The aim is to observe the relationship between the compositions of the author of the research (external) and the related mental imageries of the participants (internal). The mental imageries are sought as the spatial metaphors of the perceived architectural and environmental spaces. Observation of these is accomplished through answering the questionnaire, as a qualitative inquiry. The investigation observes whether similar patterns of spatial representation emerge among each participant's answers for each piece, and also between the pieces of the portfolio. The project focuses on art and phenomenology in order to analyse the spatial perceptions mentioned above. Woelert proposes a phenomenological approach to those occurrences, as follows:

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[11] The sound object is stretched to the scale of the soundscape, as proposed by Schaeffer in Delalande as 'a sound object occurs when (...) I perceive and identify the sound itself' (p. 268). 'In this first Schaefferian sense (in its wider meaning) there is no fixed dimension: an entire work can be heard as a sound object' (Delalande 1998: 14).

[12] 'We learn to perceptually distinguish objects, and to attend to certain ones over others, on the basis of seeing how others relate to them' (Gallagher 2008: 171).

[13] 'Externally directed cognition (EDC) involves attention directed externally (i.e., 'outside of the head or body') to stimuli present in the external world, thoughts about an attended external stimulus, semantic processing involved in interpreting an external stimulus, and actions directed at external stimuli (…) Internally directed cognition (IDC) involves attention directed internally (i.e., 'inside the head or body') to thoughts and other information that has been previously stored in long-term or working memory. It includes episodic memory retrieval (attention focused internally on re-living a past experience), simulation of future events, stimulus- independent thought streams (often dominated by self-referential content), mental imagery, and dreaming' (Dixon *et al.* 2014: 322).

> ‘Internal’ and ‘external’ manifestations, spatial metaphors, while restrictive of the scope and possibilities of conceptual thinking, simultaneously provide a heuristic scaffold that makes abstract constructs reliably available, manageable, and understandable in cognitive praxis (…) These insights can be utilized in combination with a phenomenological standpoint to situate the human organism’s living body as the generative interface between the experience of space on the one hand, and the operative structure of human conceptual thought on the other. (…) The project of a symbolic domestication of space is one of the truly distinctive features of human behavior. (Leroi-Gourhan 1993: 313 in Woelert 2011: 115, 116)

Following Woelert’s insights into connections between ‘the body as the generative interface’ and ‘human conceptual thought’, the perception of the body is observed since it includes important cues on the production of space as proposed by the French philosopher Henri Lefebvre. He underlined that ‘it is from the body that one perceives and lives the space and that it happens’[14] (Lefebvre 2000: 190). The *production of space* develops actually in three ways within the portfolio[15]:

1) During the field recording process, the recorder/composer perceives the space while soundwalking, defining his *compositional space* by his own movements while *deep listening*. This is the first production of space, which is subjective and resides in the mind of the author. Within his perception, the first layers of the composition appear;
2) During the compositional process, when the layers of sounds perceived during the recording process are classified and composed in a studio. Throughout the analysis of the questionnaire answers, the observation will investigate the relationship between what the composer has heard, what his

[14] ‘C’est à partir du corps que se perçoit et que se vit l’espace, et qu’il se produit.’
[15] Although the nature of the artworks is different (performance, composition, and sound installations), the three ways are always present, to differing degrees.

memory has released in the composition, and consequently what the audience has perceived;

3) The performance space receives the composition. The composition contains already a quantity of spaces that I name *internal spaces*. Those *internal spaces* include an addition of reverberations, which are the sonic *characteristics and sonic identities of spaces, places and locations.* Thus, the addition of multiple spaces (by layering or by convolution) produces a metaphoric sonic moiré pattern, *a polyphony of spaces*, which also integrates the performance space with its own resonant properties. Accordingly, Norman claims there is room for an emphasis of research into the *real* listening of the occupation of space by sound. In the current research, it means the *phenomena* in the occupation of the performance space by sound (including the exhibition space), and how one listens to that particular dynamic relation of sound and space:

> I would argue that while a great deal of energy has been expended on theories relating to the notion of hearing sound objects as 'real' (or by reversal, 'not real'), the notion of 'real' listening in a work of 'fictional' sound art is underexplored. (Norman in Emmerson 2003: 220)

What Norman mentions exists through the above-mentioned three key points: a) while soundwalking; b) while classifying the sound in the studio, and c) during the projection of sound in space. In this context, the interest of *real listening* in this research resides in particular in the ecological context in which the sonic event happens (Gaver 1993; Gibson 1979). However, the In/Pe project analysis takes only the points a) and b) into account, in order to observe the relationship between the composer's intention and the audience's perception.
This follows Duchamp's affirmation, which suggested 'a kind of aesthetic osmosis between the artist and the viewer via the artwork' (Massumi 2002: 227, 228). Then, common mental imagery perceived among participants as *intersubjectivity* and in relation to sound in this project relates primarily to the

representation of spatial (architectural and environmental) imagery. Arnheim insists that the perception is as described here:

> The cognitive operations called thinking are not the privilege of mental processes above and beyond perception but the essential ingredients of perception itself (…) There is no basic difference in this respect between what happens when a person looks at the world directly and when s/he sits with his eyes closed and 'thinks'. (Arnheim in Johnson in Biggs and Karlsson 2011: 149)

The last point about the absence of difference between the external view, on the one hand, and the internal representation as a same mental act, on the other, is of great interest. It forms the core of the actual investigation within the In/Pe project.

2.2. Methodologies

Methodology refers to the principles and ideas on which researchers base their procedures and strategic methods. Thus, what kind of knowledge might a piece of research based on art provide, in addition to the artworks themselves? Most importantly, which kinds of strategies are taken into account to follow such a path for practice-led research? The methodology for the current In/Pe project is based on the following procedures:

a) To develop a portfolio, observe the process, and consequently propose it to an audience;
b) To develop a tool (questionnaire) in order to collect data to validate, or to invalidate through negative outcomes, the hypotheses of the creative works;
c) Observe common threads weaving through the answers of the participants to the questionnaire and cross-compare these both within each piece and within the whole portfolio.

The In/Pe project combines two methodologies. Firstly, the practice-led methodology observes the development of a portfolio, which provides knowledge in context through the development of the artworks themselves, as

well as interviews with actors from this field and research centres involved with the topic. Secondly, an empirical survey informed by phenomenology is the second methodology, through structured interviews based on a questionnaire; this explores their answers when the participants are exposed to the artworks. The rationale behind the combination of such methodologies is to provide feedback on the possible link between the *intention* of the composer and the *perception* of the audience.[16]

This is sought in particular by observing a) how the works are perceived in order to verify the In/Pe project's idea of the research; b) how the participants perceive themselves in the environment with their body, and c) how spatially, architecturally, and environmentally they perceive the sound artworks in their mental imageries, a realisation that closes the loop in integrating the audience's point of view in order to verify or refute the initial intentions of the author. As such, phenomenology analysis through qualitative inquiry is crystallised by Merleau-Ponty as:

> In phenomenology, the researcher transcends or suspends past knowledge and experience to understand a phenomenon at a deeper level. (Merleau-Ponty 1956 in Creswell 2007: 269)

In this context, 'the subject matter of phenomenology began with consciousness and experience, and was expanded to included the human life world and to take account of the body and human action' (Leavy 2014: 129).

The experience of the perception within the space of one's own body (including its movements) is observed in the current investigation of the dynamic relations of sound and space, because phenomenology relates to consciousness and experience.

[16] That is, the difference between reception and perception resides in the order the sound reaches the brain: First, there is reception then there is perception. This means that reception relies on the physiological apparatus of sound, whereas perception relies on interpretation of sound as meaning and as a psychological act, thus relating to the mind and brain. On the other hand, in music, reception relies on the analysis of a piece (such as its appreciation), whereas perception relies instead on the emotional and metaphorical interpretation that leads to mental imagery.

2.2.1. Practice-led Research

It being practice-led, the current research observes the process of the development of a portfolio of three fixed-medium pieces, one performance and two sound installations, in *defined* contexts of productions, which implies the research of an historical background for each composition.

The investigation of the creative process focuses on fieldwork in the contexts of specific production sites, such as research centres, universities, and art residencies located around the world. Accordingly, the respective contexts of productions allow the development of the artworks while the composer remains in contact with a broad number of researchers deeply involved in the field. The locations of productions have been:

- Mamori Art Lab, Brazilian Amazon Rainforest, November 2008.
  During this residency, time was spent in the jungle to record the soundscape and its fauna. This provided not only the sonic material for the piece *De Rerum Natura,* but also crucial information on the deep listening technique in remote areas, soundwalking, and underwater recording techniques. The valuable information was then used in the other pieces of the portfolio.
- Brain Mind Institute, Swiss Institute of Technology, Lausanne, Switzerland, March to December 2009.
  The nine months spent at this research centre provided the specific knowledge on neuroscience needed for the project, for example, EEG technology and contemporary issues in neuroscience research questions. These are important for issues of perception, because they provide a deeper understanding of the different functions and areas of the brain, and how they are investigated in the current state of the art in neuroscience and perception. Thus, it was inspirational in order to develop new questions, and not only for my own research: it was equally inspiring for the scientists. In particular, they gained insights into the dichotomy between personal and extra-personal space in the auditory

domain, as yet little understood and as introduced by Prof. Olaf Blanke at Section 3.4.2.2.

During my stay, I attended PhD training courses for neuroscientists. However, my position stayed on the artistic side of inquiry, while being inspired by scientific research questions from the field. The experience contributed to the development of four projects from the portfolio (*Kinetism, Music for Brainwaves, My Extra Personal Space*, and *Voices from the Coal Mine*). Concordantly, the director of the Brain Mind Institute, Professor Pierre Magistretti, proposes similarities between art and science disciplines:

> *A Geistesblitz,* which in the case of the artist may develop into a concept similar to the scientist's theory or hypothesis. In many ways though, art has more freedom to break with the norm in places. Science incrementally evolves from established methods and theories. All intermediate steps in a work of art shape its final form – rarely however, will demands be made from the artist to re – evaluate his initial vision (…) The scientist sometimes rethinks, reformulates or even discards his initial hypothesis. (Magistretti in Scott 2010: 107)

- Interaktionslabor, Göttelborn, Germany, August 2009.
  During a one-week residency, the piece *Voices from the Coalmine* was developed. The unique facility in terms of architecture, a former coalmine in the Saarbrucken region, which includes for example the former power plant and the sound of the humming of the electricity, and huge hangars of several dimensions and shapes. It allowed me to compose the piece and interact with a musician and a psychologist working on a document about autism.
- Cité Internationale des Arts and GRM (Groupe de Recherches Musicales), Bibliothèque Nationale de France, Paris, France, January to June 2010. The stay at the Cité Internationale des Arts allowed me to live and work in Paris, while conducting the investigation at GRM (Groupe de Recherches Musicales) of Radio France. A great deal of information was gleaned through structured interviews with important figures (including

Daniel Teruggi, François Bayle, Brunhild Ferrari, and Evelyne Gayou). The Bibliothèque Nationale de France provided paramount information as well on the history of the GRM. The role of the interview is to observe the current state of the art by asking and discussing issues with composers and scholars working in the investigated area, namely, the dynamic relation between sound and space. The interviews provided important feedback on possible developments, defined milestones, and highlighted the current area of research.

- Swatch Art Peace Hotel, Ecole Offschore, Fudan University, Shanghai, China, May to October 2011 / April 2012 / November 2012 - May 2013. The stays in Shanghai followed the idea to observe relatively recent electroacoustic contexts in rapidly developing China. For the current research it was mostly a laboratory where I conducted the majority of my interviews for the questionnaire. However, it was also an important period in which I met key figures of the experimental music scene from Shanghai and Beijing, and where I developed original works based on some of the issues of the current research. In addition, I lectured French students of Fine Arts at Ecole Offshore and SIVA School of Visual Arts at Fudan University. It provided experience and discussions on electroacoustic contexts in the visual and sculptural domain within a globalised context.
- UdK (University of the Arts Berlin), Germany, October 2011 to October 2012 (UdK). The stay at the University of the Arts was included in an Erasmus exchange, where I attended compositional and sound studies programmes. In addition, I collected data for my research through administering the questionnaire to the students.
- TU (Technical University Berlin), Berlin, May 2013 to March 2015. The second stay in Berlin was in the context of the department of acoustic communication of TU, where I worked in the studio. I was acquainted with the wave field synthesis system in particular, and met important

figures such as Nicolas Collins and Miller Puckette, who also provided valuable information.

- ZKU (Centre for Art and Urbanistics Berlin), Germany, May to December 2014. In order to write the final thesis and continue with related projects in Berlin, I was granted this residency. The projects conducted within the residency by international artists investigate mainly ideas on city and architecture through many media and disciplines (theatre, performance, composition, installations, and architecture). The open discussions with architects led to an important installation blurring architecture and sound, which included many issues included in the current research. Furthermore, projects developed at the residency observe the social aspects of art, meaning that the interaction among people is itself proposed as the *artwork*, leading to new possibilities for future research in sound and space perception.

2.2.2. Qualitative Phenomenological Research

The qualitative phenomenological methodology of the thesis relies on a questionnaire investigating the respective perceptions of the participants exposed to the portfolio. The link with the portfolio is paramount, since the inquiry relies on the process of the development of the artworks: the practice-led methodology is approached not as a sole project, but in relation to the audience perception – by including perceptions of itself within the investigation process. In other words, the intention is not to develop the artworks according to the answers given, but to observe whether the intentions of the composer are validated by the perceptions of the audience. Leavy proposes the interview methodology as important in producing case studies for art-based writings, even with a small sample size:

> The *narrative method* or *narrative inquiry* attempts to collaboratively access participants' life experiences and engage in a process of storying and restorying in order to reveal multidimensional meanings and present an authentic an compelling rendering of the data. In other words, narratives are constructed out of the data through a reflexive, participatory, and aesthetic process. Research based on narrative inquiry

> produces arts-based writings. Narrative inquiry often relies on small sample sizes but produces rich case studies. (Leavy 2009: 27-28)

The narratives are the participants' answers to the questionnaire as developed at Chapter Four. Those are the descriptions of the audience perceptions of their own mental imageries in relations to the portfolio listening sessions as qualitative data. Moreover, Creswell introduces the following procedures for a qualitative phenomenological approach, and which is the chosen method for the actual analysis of the project:

> Data analysts go through the data (e.g. interview transcriptions) and highlight 'significant statements', sentences, or quotes that provide an understanding of how the participants experienced the phenomenon. (Creswell 2007: 61)

On that basis, the compositional processes as research follow the proposal of Sloboda that:

> There seems to be a growing consensus that a central problem for the psychology of music is to explain *the structure and content of musical experience.* (Sloboda 1986 in Deliège and Davidson 2011: 18)

The answers to the questionnaire highlight the content of mental imagery after dedicated listening to the compositions and the related spatial implications in the audience's perceptions. As such, and following Sloboda's proposal, the current research wishes to provide data on *the structure and content of musical experience* by providing information as spatial typology.

A majority of the participants in the survey came from the arts, either music or fine arts, as is further developed in Chapter Four. The reason for choosing them lay in their inclination and training in spatial representation, and thus in architectural and environment representation.

The qualitative methodology allows the revelations of the experiences of the participants only through the narratives of their experience; Throop claims that:

> Individuals can immediately experience feeling states that are highly conceptually elaborated but yet not explicitly reflected upon in the moment of their immediate duration in direct experience. (Throop

2005: 9)

The investigation was conducted without a control group, because it was analysed through individual experiences with structured interviews. In addition, most of the interviews were made during fieldwork, where organising any contributory features of control groups is problematic. This is a pilot study, and control groups will be included in future research, when developed in a laboratory context. The above-mentioned proposals relate to the observation of the experience of the participants as the main scope, and as explored in the twentieth century by philosophers such as Husserl and Merleau-Ponty (Husserl 1931; Merleau-Ponty 1963). Hence, in Husserlian phenomenology it is claimed that:

> Our experience is directed toward — represents or 'intends' — things only through particular concepts, thoughts, ideas, images, etc. These make up the meaning or content of a given experience, and are distinct from the things they present or mean. (Phenomenology 2013: 2)

In relation to the In/Pe project, the investigated experience of the audience relies on the 'ideas, images' (as perceptions) of architectural and environmental spaces, which make up the meaning, and it is thus distinct from the composition *per se* (things they present or mean). As proposed by Merleau-Ponty:

> Merleau-Ponty focused on the 'body image', our experience of our own body and its significance in our activities (…) In short, consciousness is embodied (in the world), and equally body is infused with consciousness (with cognition of the world). (*Ibid:* 11)

The current project aims to observe how the audience perceives their body in the architectural and environmental space through the listening experience. Husserl and Merleau-Ponty 'spoke of pure description of lived experience' (*Ibid*: 4), which is the lived experience, through listening, of the spaces investigated by the research. Heidegger in Ratcliffe also 'stresses that the body, although neglected by his previous works, is important and needs to be discussed by the phenomenologist' (Ratcliffe in Gallagher and Schmicking 2010: 133). The body, in the present research, is included in the exploration and creation of space, by

a) the movement of the composer while field recording and b) by the audience when listening and perceiving the architectural and environmental space. Thus, the body is present in the mind of the audience by exploring what the composer has recorded and composed. Varela *et al.* want to push those ideas further by including the link between mind and body:

> Particularly impressive to us is the convergence that we have discovered among some of the main theme of Buddhist doctrine, phenomenology, and cognitive science – themes concerning the self and the relation between subject and object. (Varela *et al.* 1991: 33)

The idea relates to how the audience (subject) perceive the spaces (object) defined by the composer, while field recording and in the studio. Varela proposes an embodied experience through the idea of *enaction,* which goes beyond the mind:

> According to the enactive approach, the human mind is embodied in our entire organism and embedded in the world, and hence is not reducible to structures inside the head. Our mental lives involve three permanent and intertwined modes of bodily activity – self-regulation, sensorimotor coupling, and intersubjective interaction. (Thompson and Varela 2001 in Thompson 2005: 408)

The idea of enaction from Varela addresses the perception of the environment through embodiment. This is explored with the proposal that *perceived* space is embodied by the composer while soundwalking in the field and later perceived by the audience, leading to an intersubjective perception. Colombetti and Thompson propose for the enactive approach that:

> The human mind is embodied in our entire organism and embedded in the world, and hence is not reducible to structures inside the head. Meaning and experience are created by, or enacted through, the continuous reciprocal interaction of the brain, the body, and the world. (Colombetti and Thompson in Overton, Müller and Newman 2008: 56)

Here, again, the research investigates the meaning and experience of the composer through the continuous reciprocal experience of his brain, body, and the world surrounding him while field recording. It explores how the audience,

as intersubjectivity, perceives the embodiment of the experience of the world of the composer by listening to the pieces.

2.2.3. Hypotheses

I would like to set out the relationship between the composition of electroacoustic pieces (*Intention*) and the resulting *perception* from an audience. I expect to find among listeners a common thread of perceived architectures and environments in mental imageries. Embodiment will also play a role, being the perception of one's own body and its movement in space, and the embodiment of the perceived architectural and environmental space, meaning the perception of the body in such spaces in mental imagery while listening.

2.3. Related Research

The base of reflexion for Intention/Perception (In/Pe) project, which is the analysis of the answers to a questionnaire based on the portfolio of the current research, derives partially from the Intention/Reception (I/R) project developed by Landy and Weale (Landy in Simoni 2006; Weale 2006):

> The 'Intention/Reception Project' involves introducing sound-based works that are unknown to the listening subjects, and then evaluating their listening experience. (…) The purpose of the project is to investigate to what extent familiarity contributes to *accessibility* and *appreciation* and to what extent *intention and reception meet* in the very particular corpus of electroacoustic music. (Landy 2006a: 29 in Landy 2007: 38)

The convergence relies on evaluating the listening experience of the participants. However, the I/R is a research project aimed at creating a bridge between the intention of the composer and the reception of the listener in the context of electroacoustic music by articulating the intent and by repeated listening sessions (*Ibid:* 29), which allows *familiarity* with the artworks. This leads to questions related to access:

> If nothing else, the Intention/Reception project serves as a lobbying tool to demonstrate the potential interest in this music by allowing people to discover it. (*Ibid:* 52)

Thus, and as proposed by Landy, the I/R project wishes to facilitate access to electroacoustic music, whereas In/Pe's aim is to observe the mental perception of spaces. Another difference between the two projects relies on the number of times the compositions are played. In In/Pe, the compositions are played only once, and thus the *first impression* is observed*,* in line with the proposal of the philosopher Tonino Griffero:

> The first impression is an affective corporeal involvement that, interrupting the habitual observational and pragmatic flux, can, for this very immediacy, represent for the subject an identity certificate much better than the *cogito* – and, even more so, better than objective facts, which as such are ours as much as others', in principle. (Griffero 2014: 88)

The idea of 'aboutness'[17] of mental states in relation to intentionality is sought in In/Pe through the perception of architectural spaces and environments in dedicated listening. Accordingly, the philosopher Charles Siewert proposes a link between intentionality and mental representation:

> Intentionality has to do with the directedness or aboutness of mental states — the fact that, for example, one's thinking is *of* or *about* something. Intentionality includes, and is sometimes taken to be equivalent to, what is called 'mental representation'. (Siewert 2006)

This is both an art project and a piece of long-term research. The In/Pe project aims to cross the boundaries of art and science by refining the methodology through including cognitive neuroscience and art. The current In/Pe project includes a survey based on phenomenology that explores audience responses to a portfolio. For future research, cognitive neuroscience methods will be included in order to approach in greater depth issues of perception.

[17] Phenomenologists try to pin down the 'aboutness' features of particular mental states.

Chapter Three
PORTFOLIO

The Fall
A Sound Installation and an Eight-channel Composition

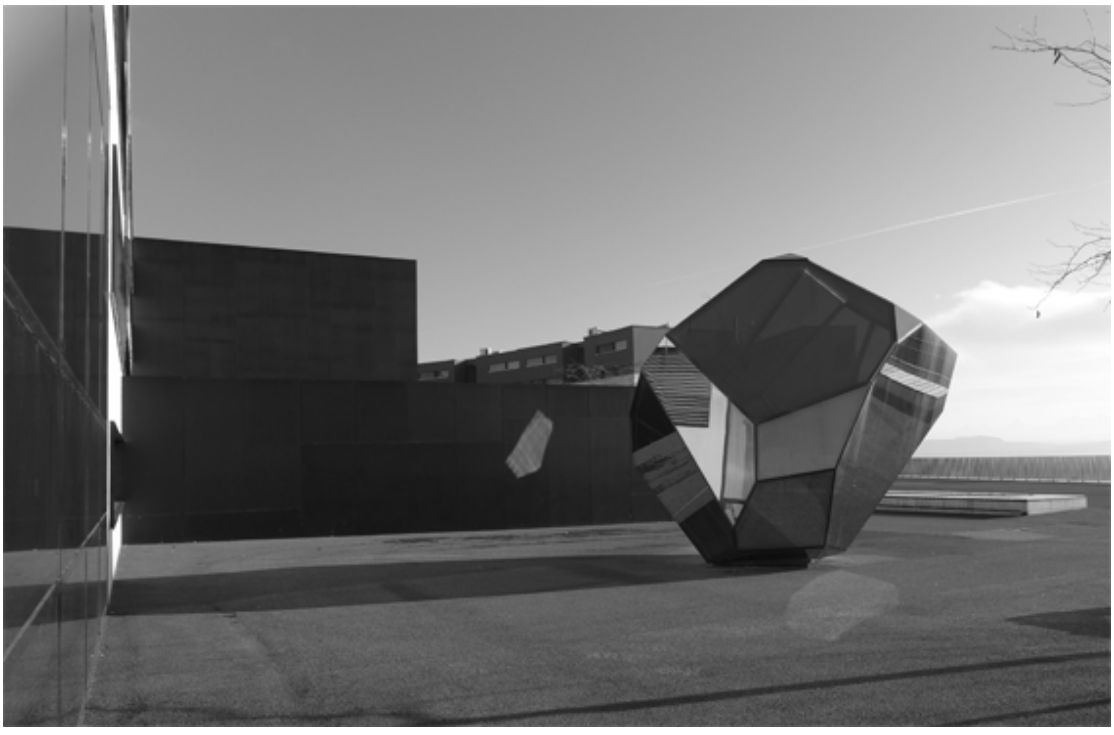

Fig. 3.1.1 Polyhedron sculpture by Fred Fischer, Neuchâtel (Forcucci)

The multiple had been thought, perhaps, but it hadn't been sounded
Michel Serres – Genesis

Summary

The Fall observes the idea of plasticity as being a language transferable from the fine arts to the sonic arts. Within these parameters, the artwork is developed as a tangible form of sonic sculpture by establishing a dialogue with a sculptor. Moreover, the piece integrates the sounds of the site where the sculpture is located. The documentation plays an important role and questions the archiving of ephemeral and site-specific sonic artworks. Are the spatial considerations of the composition perceived when it is played as a stand-alone fixed media piece in a concert situation? *The Fall* fits into the real space and virtual space categories of the map of research.

3.1.1. Introduction

The Fall is a sound installation and an eight-channel piece surrounding and resonating with a sculpture erected in front of the new building of the Conservatory of Neuchâtel in Switzerland. The piece was played only once, in May 2009, for the opening ceremony of the sculpture and the building. The sculpture represents a meteorite that crashed to earth: a glass polyhedron whose structure includes neon lights turned on at night. The artwork is located next to a railway station, with trains going back and forth along the north side, giving its own noticeable sonic identity to the site, and with a view of the lake to the south.

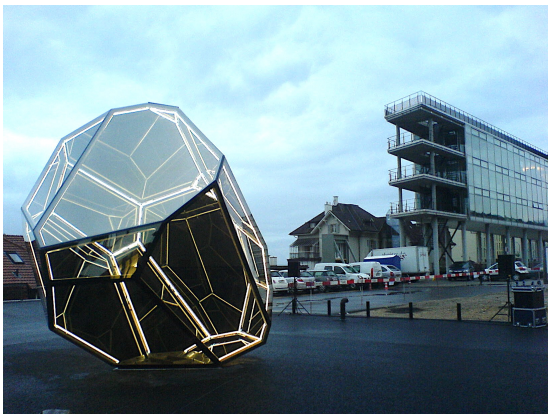

Fig. 3.1.2 Polyhedron sculpture of glass with neon lights surrounded by loudspeakers (Forcucci)

Fig. 3.1.3 Railway lines to the north (Forcucci)

Fig. 3.1.4 Lake to the south (Forcucci)

The Fall as a composition and sound installation is intended to create a dialogue with the sculpture (a glass polyhedron) in exploring the same spatial considerations, conceptual ideas and metaphorical meanings, in order to become a single entity, namely:

- The impression of a floating sculpture (a glass polyhedron), being in a precarious equilibrium yet while standing;
- The evocation of transparency from the polyhedron glass sculpture;
- The journey of a meteorite and its crash landing in front of the Conservatory.

These three points form the central themes of the composition. The aim is to understand how plastic language from the fine arts can be included into and developed here for a sound sculpture[18], meaning that the sound work itself aims to create a situation that redifines the place where it is held. The composition is

[18] The term *sound sculpture* encompasses here a composition and a sound installation approached as a sculpture, and is different from the musicologist de la Motte-Haber's proposal:

> Single sounding objects that offer the viewer a visible material opponent can be referred to as sound sculptures. Sound sculptures can be hung in different rooms, meaning they are not necessarily dependent on a site. In contrast, the sound installation is site-specific. Sound installations normally form an arrangement or environment that surrounds the recipient, covers him or her with sound, or only connects with the recipient when it is in motion. Material objects do not necessarily need to be present. Sound technical equipment that emits either sound synthesized on the spot, or sound recordings via loudspeakers, might need to be present. Hybrids of sound installations and sound sculptures are installations in which numerous sound sculptures or objects are fitted together and installed in one place (Seiffarth 2012).

approached through a dialogue with the sculptor[19] by developing a non-illustrative composition, and in order to avoid redundancy. The outcomes of this dialogue provide insights for the piece.

In Section 3.1.1, the relation between real space and virtual space is proposed, as is the idea of a plastic language of sound, where sound can give or receive form. The concept is in relation to space: how space is defined by sound (sound gives form) and sound is defined by space (sound receives form). As a background, artists and artworks including the idea of sound sculpture will be introduced. Then, an interview with the sculptor brings his views on sound and sculpture. Section 3.1.2 provides the context of the work through the situation of the recorded sites and the related spatial considerations; these include a railway station and a lake. The section moves towards the documentation of an ephemeral and site-specific sound sculpture. The idea of transferring the piece to another location is approached in exploring previous artists' works.

Section 3.1.3 The composition aspect of the work is proposed through the recordings that include found sounds, soundscapes, a cello, the sound organisation of those elements, and their final diffusion through eight loudspeakers. Section 3.1.4 concludes by observing how plastic language in fine arts has been applied to the *The Fall*, how a site-specific work can become a concert piece, and where future research may lead.

3.1.1.1 Mapping Real Space and Virtual Space

The Fall fits into the real space and virtual space categories of the map of research. 'Real space' relates to field recordings and the acoustic properties of the recorded locations, which are a railway station and the movements of trains, a lake, the urban context, and the acoustic reverberation of the places. 'Virtual spaces' relate to a perceived constructed space: real sound from the location, where the sculpture stands, have been recorded, processed, and re-projected through eight loudspeakers. The listener experiences simultaneously the

[19] Fred Fischer.

sounds emerging from the location and those merging with those from the loudspeakers. The perception of a subjective personal experience emanates from the resulting perceived constructed space.

The major sonic identity emerging from the place is the sound of the railway station and the related movements of the trains (such as braking and acceleration). Secondly, the important visual component of the location is the lake on the south side. The movements of water into and in the lake have been recorded. There also enters the sound of a drip from the staircase of a house (Fig. 3.1.5). The roof of the stairwell twenty metres above was damaged and water dripped through. Although it was not planned as belonging to the sculpture's surroundings, the drip is included as spatial counterpoint to the water elements found in the lake: waves recorded from a platform (Fig. 3.1.6) and a river flowing into the lake (Fig. 3.1.7). The dripping contrasts with the greater movements of water.

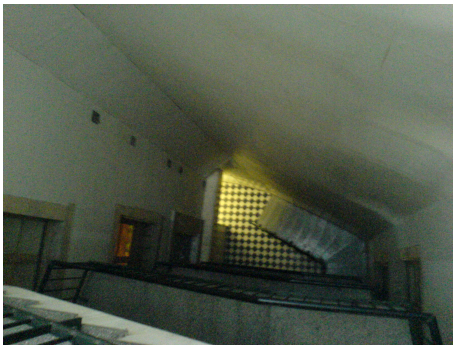

Fig. 3.1.5 Stairwell and drip recordings (Forcucci)

Fig. 3.1.6 Platform for waves recordings (Forcucci)

Fig. 3.1.7 River flowing into the lake recordings (Forcucci)

3.1.1.2 Plastic Language of Sound

Insights from the fine arts offer possibilities to improve the language of sonic arts by combining knowledge from both disciplines. According to the discussion with the sculptor at Section 3.1.4.1, the addition of sound to the sculpture on site provides an augmentation to – and not a illustration of – the sculpture. This means that the adding of the sound to the visual element intends, in this particular case, to create an augmentation of the materiality, and leads to an additional spatial dimension. *The Fall* is a composition including constitutive elements from sound installation, in particular its relation to space and environment. In line with the above considerations, Rebentisch proposes that:

> Sound Installation, a hybrid situated between visual arts and music, is obviously about something else: the constitutive relation of the acoustic phenomenon to space (…) This relation has been engaged with regard both to the discovery of space as a resonating space and to the acoustic relation of spaces, or more generally, of environments; and the latter in turn in two respects: concerning the creation of acoustic spatial atmospheres, and in a reflection on the acoustic 'spaces' or 'landscapes' that surround us every day. (Rebentisch 2012: 211-212)

Furlong proposes the following characteristics and similarities with more traditional media such as painting and sculpture:

> As well as its own unique characteristics, recorded sound shares many of the characteristics of more traditional media such as painting and sculpture. Collage, juxtaposition, reduction and addition, contrast, abstraction, realism and so on are all techniques at the artist's disposal. It also has the potential to generate visual imagery in the mind of the listener. As well as defining its own space, recorded sound is also capable of defining and interacting with physical space in a sculptural sense. (Furlong in Kelly 2011: 68)

Most interestingly in the context of *The Fall* are suggestions by Furlong that 'the potential to generate visual imagery in the mind of the listener' and how 'recorded sound is also capable of defining and interacting with physical space in a sculptural sense' by resonating and reverberating with it.

Specific questions need to be addressed, such as the spatial concerns of a sonic piece emerging when related to a sculpture. The perception of space in

the chosen locations is a main concern in the development of the piece. How those spaces may be revealed in the composition is a further avenue of enquiry. Hence, the investigation of spatial issues through conception and composition are included at the earlier stage of development. It is achieved by carefully investigating the surroundings through a dedicated listening to the location. The sound of the composition is processed with the same spatial considerations as is the sculpture. The process includes similarity with the composition of an electroacoustic piece in regard to the organisation of sounds, timbre, pitch, and spatial issues, and by balancing real and abstracted sounds. The spatial properties of the sounds and their textures are *allusions* to their original nature. The *allusions* are created with the use of convolution between different field recordings. Thus the space and identity included in one sound (i.e. its reverberant properties) are blended with one another in both sound and space. The physical sculpture gives an impression of being suspended between earth and sky. This idea of suspension is also an element of the composition.

3.1.1.3 Background

The elaboration of the piece involves the development of a plastic language of sound, by resonating both with the location where it is presented and with a sculpture. The following artists inspired the idea of sound sculpture:

- **Marcel Duchamp / Sound Sculpture**

Duchamp is well known for his ready-mades, and he also coined the term 'sound sculpture' through the following sentence:

> Sounds lasting and leaving from different places and forming a sounding sculpture which lasts. (Kelly 2011: 168)

The sound coming from the different places of the environment and included in *The Fall* indeed forms a sound sculpture, while in contrast the sound sculpture is lasting only for the duration of the composition.

- **Bruce Nauman / Doppelgänger / UFO**

The uniqueness of *The Fall* resides in the rotation of the sound and therefore a modification of the exhibition space induced by the piece through the Doppler effect. This is properly a sound sculpture with a plastic approach:

> Bruce Nauman's *Doppelgänger/UFO* (1988) is comprised of a rotating steel beam to which two audiocassettes have been attached, exploring the aural phenomenon of the Doppler effect, where sound waves become distorted as the object is put into motion. Nauman urges the viewer to engage directly with dynamic sound, encouraging us to consider the everyday noises that flash past us with greater aesthetic appreciation, such as the rush of moving vehicles, or the fragments of overheard conversations that fill our ears within urban environments. (Analog, Group Exhibition 2013)

Fig. 3.1.8 Doppelgänger/UFO, 1988 (Nauman)

In *The Fall*, the Doppler effect is also present through the rotation of the sound around the sculpture with the eight loudspeakers, intending to create a whole among the movement of sound, the composition, the sound from the location and the sculpture with its multiple reflections through the glass.

- **Rolf Julius**

His work is a combination of visual and sonic materials, leading not to visual music, but to a combination that would emphasis the perception of the space in a synaesthetic way:

> Despite the constancy of the musical discourse characterizing his practice, the approach of Julius is essentially intermedial. And it's precisely in this organic way of making get along the sonic and the visual that perhaps lies one of the causes of distinction: 'the people should look and listen to the space – he comments – by trying perhaps to detect the familiar in the non-familiar. The musical forms are known by most people, as are visual forms like sculpture or painting (…) It's the combination of forms that are at the same time musical and visual that creates something new.'[20] (Balit 2013)

The idea of 'something new' emanating from the combination of the sonic and the visual relies also on the emergence of a work that is ephemeral; it exists only in the mind of the audience attending the piece, since the combination in *The Fall* is the resonance between the sound and the visual (e.g. the sculpture (a glass polyhedron), the environment, and the reflection).

- **Luc Ferrari**

On the compositional side, two works from the composer Luc Ferrari are major references for *The Fall* for their propensity to reveal a location:

- *Presque Rien nr.1*: For its vision in presenting a location without altering sonic material;
- *Far West News*: The material is manipulated, yet it provides a good idea of the location and the sensations of movement into it.

However, *The Fall* is far more abstract than either of these two pieces, as the composition maintains the idea of the trains and the water movements through *allusions*. Thus the idea, through the abstraction of the recorded material, is to reveal a location in a way that is more subjective than a narrative one. It is more subjective because the allusions relate to the memory of the listener through

[20] 'Malgré l'assiduité du discours musical caractérisant sa pratique, l'approche de Julius reste en effet essentiellement intermédiale. Et c'est précisément dans cette manière organique de faire cohabiter le sonore et le visuel que réside peut-être l'un des motifs de distinction; "les gens devraient regarder et écouter l'espace — observe-t-il — en essayant peut-être de déceler le familier dans le non familier. Les formes musicales sont connues de la plupart des gens, de même que les formes visuelles comme la sculpture ou la peinture (…) C'est la combinaison de formes à la fois musicales et visuelles qui crée quelque chose de nouveau"' (Balit 2013).

abstraction, whereas the narrative, as in Ferrari, provides already a framework for the composition.

3.1.1.4 Interview with Sculptor

The Fall is an attempt to create an augmented sculpture, where the process starts with a discussion with the sculptor about the aesthetic issues and spatial conceptions leading to the conception of his physical work. The sculpture is a glass polyhedron with an interior neon light, which means that depending on where and when one looks at it (e.g. night or day), different perspectives will be perceived. On 18 November 2013, I again met with the sculptor Fred Fischer for an interview in Berlin to discuss the issues and insights resulting from our collaboration:

Luca Forcucci: Can you describe the purpose of our collaboration?
Fred Fischer: The context was the opening of the new Conservatory in Neuchâtel, Switzerland, for which I won a competition to design the public sculpture.
For me sound and space are intrinsically linked and I perceive sound as having a formal aspect. I thought that sound would provide a complementary form when joined with the sculpture and that they would amplify each other; it would lead to the combination of a visible and invisible form.
The sculpture is a game between the visible and the invisible, because of the glass of the sculpture. It provides transparency and reflection, so it's both visible and invisible at the same time.

LF: Can you describe the collaboration, the dialogue, what did you discover?
FF: Usually, a plastician works alone, and thus there is not much feedback or an outside view until the outcome; even between artists there is not much dialogue. Then, meeting with someone who has a view as sonic plastician brought sonic textures, as if an augmentation of the materiality, and it added an additional dimension. The sound was an augmentation, not an illustration.

LF: How do you think sound can encapsulate an idea of plasticity? Would it be close to the plastic language of sculpture?
FF: It relies for me on the idea of echoes and reflections of space, indirect and stealthy, like waves floating in a space. Therefore sound and image are very close. The glass of the sculpture reflects the light. This is an indirect image of the reality, such as for the sound of the train arriving at the station, there is the sound of the brakes. The reflections and the sound provide a multitude of dimensions (e.g. a kind of cubism). Maybe the perception of the space equals

the perception of an ensemble of frequencies. There is a spatial perception through movement.

LF: Is sound a sculptural form for you? Why?
FF: Yes, through spatialisation sound becomes sculpture by adding a space (e.g. the Doppler effect). Sound, for me, has a materiality and texture without spatialisation. It moves in space and spatialisations add volumetry. When it's not spatialised, there is the illusion of depth, it's like a perspective in painting.

LF: Does the sound resonate with the piece? Is there a dialogue? How?
FF: The piece is the result of a dialogue between us two, first and foremost. Then, when the two pieces were together, they were saying the same things, but without redundancy, like an exquisite corpse, without illustration.
My piece talks of space, volume, transparency, dematerialisation, night and day. The drips falling in your piece and its own fluidity created a dialogue. All the elements created a result that was bigger than just two things put together. That's the grey zone between the two pieces, they speak to each other, and it's more than just an addition. It's not one or the other; it's the vibrational space between the two. Because when it happens, it was not only the sculpture or only the sound piece. It was the moment that was unique and ephemeral.
My piece includes instability, and has been conceived to dialogue with the architecture of the conservatory, which is four extruded blocs, and two of them are suspended in the void. By observing the building I noticed that a diagonal was missing; the diagonal is the movement, the unbalance, and the moment. Therefore I wanted to give to my piece that instability. The sound of your piece and the encapsulated sounds resonating with the space of the building gave that movement. That was just temporal and ephemeral. You provided a huge density at that moment.

LF: How do you think a language has been developed between sculpture and sound?
FF: I wanted to have your view, not an illustration. I wanted your view of the space, and therefore you had to understand my piece and the background, and then liberate your self from that commission in order to develop a piece *per se.* It was an enriching experience for me. As a sculptor I visualise sound as a shape in space. For me it has a volume (or close to a volume, an illusion of volume) and a shape. The interest in your piece, it's imaged without being illustrative, since my piece is abstract. It created an abstracted narrative, always at the limit of figuration and abstraction. It's those borders that interest me. The sculpture is transformed when the light are turned on at night, and the volume is deconstructed, because the neons are on the structure and the volume is projected *in infinitum.* It's not any more an external reflection, but an internal one. The analogy with sound is the transformation from one thing to the other. During the opening there was this space of transition between the two pieces, a space non-definite between three states, between abstraction, narration and figuration. My piece reflects the environment around it during the day, dialogue

with the building, you have been looking for sound that interact with this space, looking for material and textures. This how I see the echo with the environment.

LF: What were your spatial considerations with the site and how do you perceive those considerations when combined with the sound piece?
FF: The site has the verticality of the building, the diagonal of the mountain behind the site and the horizontality of the lake. I wanted a new diagonal with the mountain in relation to the meteorite falling from the sky and impact on earth, creating a moment preceding the impact and have a density of the meteor and the fragility of the glass. I wanted a volume that changed constantly in function of the point of view.
I preferred not to hear that, in order not to obtain a redundancy. But, when the sound started to turn around the sculpture, I perceived it as an additional space, which was like a trance, in that sense it was there to provide another perspective, to lose reference and allow the audience to enter an imaginary space. Imaginary in the sense that is not the raison or the subjectivity, but where the subjectivity is stronger than the reality.
Then we had those drips that fell, providing a verticality, and they defined a space, because there is a resonance in the sound of the drips, one feel a space, an empty space, a spatiality is integrated. The drips are not illustrative. The sound is like a wind that turns and a stable vibration.

3.1.2 Context of the work itself

In May 2009, the construction of Neuchâtel's new Conservatory was completed and *The Fall* was performed during the opening ceremony. Forty students, saxophone players, surrounded the audience inside the building and herded it towards the sculpture, blowing mouth sounds. *The Fall* started when the audience was inside the circle of eight loudspeakers and ended once the sculpture was unveiled. As soon as *The Fall* started, the audience suddenly fell silent.

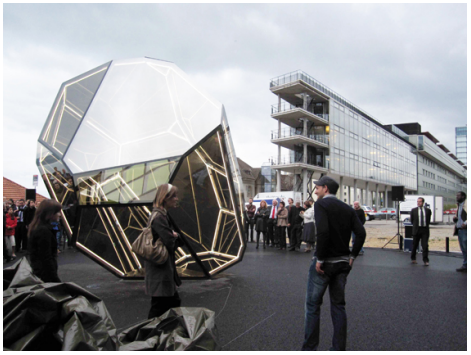

Fig. 3.1.9 Opening ceremony (Forcucci)

Fig. 3.1.10 Opening ceremony (Forcucci)

The work fits in the sound installation category, as an installation surrounding a sculpture, and a composition emanating from it, which is also a stand-alone piece. The combination of the composition, the sound installation, the sculpture leads to a sound sculpture. Organised sounds are merged together in order to sculpt a coherent form. Those sounds are trains, waves from a lake, a river flowing into the lake, and water dripping from a staircase. The cello is the only instrument, and it is treated as a sound texture. Organised sounds pay tribute to Edgar Varèse in terms of their organisation in space, which is a key element of *The Fall.* Varèse is cited by the musicologist Olivia Mattis:

> Taking the elements of sound as a group, it is possible to subdivide this mass; it can be split up into other masses, into other volumes, into other planes, by loudspeakers arranged in different places, giving the impression of movement through space, although what we have today is but a kind of ideogram. (Varèse in Mattis 1992: 573)

The idea of an ideogram refers to the notion of the distribution of sound and as a metaphor with visual arts as (e.g. splitting masses, planes, loudspeaker arrangement) leading to an ideogram.

The Fall lies in a grey area where sounds are *allusions* to the original acoustic spaces, places and their intrinsic related properties, because they have been treated by convolution (e.g. water with trains, cello with water) and thus the sounds are abstracted. Sonic images are intended to create and to suggest an imaginary landscape to the audience by spatial *allusions*. Convolution shapes and blends the sounds together, by taking the impulse of a space and by applying it to another one by synthesis, avoiding a direct recognition of the sources; instead, sounds and spaces are telescoped[21] together sonically. The organisation and recombination by convolution of the sounds are also a recombination of the acoustic spaces contained intrinsically into each sound, leading to artificial and imaginary spaces.

[21] 'Telescoping' spaces means projecting and inserting the sonic characteristics of the different spaces into each other.

3.1.2.1 Situation

Behind the sculpture and protected by the building of the new Conservatory, there is a railway station with trains going back and forth. In front there is a 180-degree view of Lake Neuchâtel. The eight loudspeakers for the performance are placed around the sculpture at a radius of approximately ten metres.

3.1.2.2 Spatial Consideration

The piece is site-specific and the following principles are applied:

- To give several possible angles of listening to the piece similarly to how the sculptor gives several possible points of view;
- To provide a central structure to *The Fall* from which the rest of the composition is articulated. The sound of the train is, from a timbral point of view, the central element. The sculpture is the visual element and central structure on the place where it is held;
- To approach the sound and acoustical properties of the performance space as keys element of the composition, as a sculpture would resonate with a chosen space.

The Fall is a hybrid between a stand-alone eight-channel fixed-medium composition and a sound installation, combined with a real sculpture, and the proposed term for such a hybrid is a *sound sculpture*. Although the fixed-medium composition may be played in concert without the real sculpture on site, *The Fall* as a sound sculpture is site-specific, since the site's sounds and the locations have been closely observed and taken into consideration during its conception, and reprojected by the eight loudspeakers on the site where the original sounds are. Rosenthal proposes the following definition and conditions for a site-specific installation:

> Indeed, the site-specific artist will have spent considerable time exploring the location of the work, hence, an analysis of the composition of a site-specific installation must include its locale, because it derives its very form and perhaps physical substance, too, as well as its meaning, from the context. Moving it is impossible, since the work cannot be understood or seen except in relation to the

> place. The viewer *witnesses* a dialogue, as it were, between the artist and the space. (Rosenthal 2003: 38)

In *The Fall,* a dedicated site listening observation leads to specific sound recordings, namely, the sonic identity which defines the site. Moving the sound installation is indeed impossible; the sound sculpture relates closely to the glass polyhedron sculpture, which has been developed with precise elements through a dialogue between the artists (the composer and the sculptor) and the space invites the viewer (and as well auditor in the present case) to perceive the space of transition between the two pieces, a space non-definite among three states, among abstraction, narration, and figuration.

3.1.2.3 Documenting Site-specificity and Ephemerality

The Fall is a site-specific work and its constitutive elements are:

- Field recordings related to the location and surrounding spaces;
- Spatial considerations related to a specific sculpture;
- An attempt to recreate the sonic identity of the place through sonic allusions.

Site-specific artworks relate to the site through social, historical or sonic elements. To document such an ephemeral work, in order to provide an idea of the original experience for those unable to attend, the main elements are:

- The Eight-Channel composition;
- The present text and in particular the interview with the sculptor;
- A short documentary movie showing the environment of the sculpture.

3.1.2.4 Transferring to another Location

The discussion now moves towards the observation and comparison of works of art, ones that re-locate sound or material from one or more places/spaces to others, and in particular that recombine distant and close sounds into one and the same location. Those sounds are recorded or captured live and relocate into

one single place, thus a layering and addition of places is created. There is an analogy, as described by Licht, with:

> [T]he translocation of Robert Smithson's non-sites, in which he took soil from various locations and re-situated it in galleries. It is also particularly felt in Maryanne Amacher's *City Links* series begun in 1967, in which sounds from urban environments were transmitted in real time to another location, sometimes an exhibition space but later her own home studio. (Licht 2009: 5)

The conceptual idea proposes a location abstracted from its original location, and re-proposed somewhere else, such as a gallery, and becomes the work, as developed by the artist Robert Smithson for the *Non-Site*:

> *The Non-Site (an indoor earthwork)* is a three dimensional logical picture that is *abstract*, yet it *represents* an actual site in N.J. (The Pine Barrens Plains). It is by this dimensional metaphor that one site can represent another site, which does not resemble it - this *The Non-Site* (…) Between the *actual site* in the Pine Barrens and *The Non-Site* itself exists a space of metaphoric significance. It could be that "travel" in this space is a vast metaphor. (Smithson 1996)

Furthermore, this idea of recombining places and spaces (transferring multiple locations into one place and then creating a new one) pushes the sound of a place further in Maryanne Amacher's work, as stated by Licht:

> After a while (when she had the Boston harbour sounds transmitted to her studio) I realized that there was always a fundamental pitch, there was a whole tone of space. So I made various installations I called 'Tone and Place'. When I analysed this I discovered a low F# was coming from Boston Harbour at 91-93Hz. I did not know exactly what was producing this tone, but that was the tone of space, really the colour of it. (The characteristic tone of a continuous six-month transmission from New York Harbour in 1970-80 was an E.). (Licht 2007: 272)

Maryanne Amacher transfers also the tone of the place, and this is a particular notion when re-locating works. In comparison with *The Fall*, the tone of the place is considered as the main sound identity of the place, which is in this case the sound of the trains. Those are, however, recorded,

abstracted with other sounds from other locations (the lake, the staircase), and projected at the same place.

Bill Fontana's work *Sound Island* from 1994 transmits the sound of the coast from Normandy through wireless technology and reproduces it in the centre of Paris at L'Arc de Triomphe through multiple loudspeakers:

> Fontana's musical network generally consists of identifying a given acoustic phenomenon found within an environment and amplifying this in real time to a listening point situated at times well beyond the original site. To further such methods, Fontana links multiple sites and their inherent acoustic events, bringing an array of locations into a single focal point. The spatiality of the work thus occurs on two levels: by appropriating given locations and their sounds, expanding out through broadcast and contracting back in technological manoeuvres, creating an aural network of environmental information. (LaBelle 2006: 231)

In *The Fall*, the close and distant sounds are the nearby railway station and the distant lake. The lake is divided into two kinds of sound, surface water and underwater sounds; the material is then re-combined in the piece. The sounds echo the place where the sculpture stands; now it is rather as a fixed media piece than the live transmission of sound material found in the works of Amacher and Fontana. Therefore, the geography of the spaces is integrated into the piece and becomes perceptible through careful listening. The 'colour' of the place that is found in Amacher's piece, with the low F# coming from Boston Harbour at 91-93Hz, is particularly present in *The Fall*, with the sound of the railway and the trains. These are convoluted with the sounds of the other elements (e.g. water and cello).

3.1.3 Composition

The Fall merges different close and distant sounds (the trains, the waves of the lake, the river, and the water drops), as well as the places/spaces present in the area surrounding the sculpture, and a cello. The cello is metaphorically the sound of the meteorite. The aim is to blend sounds from different spaces, and is intended to create new timbres with allusions through convolution to the original

ones. The piece is played outdoors, thus the low frequencies are pushed not only in order to render the piece physical, but also to provide physicality to the piece.

3.1.3.1 Recording the Sounds and the Cello

The field recordings were made in four areas of the city of Neuchâtel. The first recording comes from the trains in the railway station behind the Conservatory. At first, a close relationship and shift exists between the sounds of 'real' trains passing during the opening and the recorded and diffused ones from the piece. Although those from *The Fall* are convoluted with other sounds, the timbre remains the same. The second recording comes from a twenty-metre-high staircase: the roof of the stairwell was cracked so, during a storm, falling drops of water created a regular pulse on the wall. The pulse is an introduction to the piece (similarly to the metaphoric pulse of the meteorite's entering into the cosmos) and the space of that staircase is included. The third recording comes from the lakeside at night. The recordings have been made from above the water, on a platform, in order to take in both the movement of the waves and their repercussions when crashing onto a retaining wall. The fourth recording is of a river flowing into the lake, recorded with a hydrophone.

The recombination of the sounds and their intrinsic spaces leads indeed to schizophonia, as described by Sterne:

> Barry Truax and R. Murray Schafer have coined the term *schizophonia* to describe the 'split between an original sound and its electroacoustic reproduction' enabled by sound-reproduction technologies. The Greek prefix *schizo* – means 'split' and also has a convenient connotation of 'psychological aberration' for these authors. Truax and Schafer also argue that reproduction removes sound from its original context. (Sterne 2003: 20)

The actual sound of the place where the sculpture is placed, combined with the abstracted recordings of the place from *The Fall*, creates the schizophonia of the piece.

The cello is a strong sonic element suggesting the movement and the mass of the meteorite as a dense corpus moving in the cosmos. The low

tones of the instrument are suitable for this purpose. The timbre provided by the instrument is in sharp contrast with the field recordings. The cello player[22] was requested to imagine and play the sound of a meteorite. Then, the recorded material was selected in sections, and was processed by convolution with the sounds of the water or the trains, leading to another element of schizophonia.

3.1.3.2 Sound Organisation

According to Simon Emmerson's grid, the language of *The Fall* resides on the side of aural discourse, given the abstract nature of the sounds. The water is the mimetic side of the piece with sounds recorded underwater and from above, and those sounds are unprocessed. The real and abstracted sounds are generating strata in which articulations are created. According to Pauli, combining the abstract and the real leads in the composition:

> I thought it had to be possible to retain absolutely the structural qualities of the old *musique concrete* without throwing away the content of reality of the material, which it had originally. It had to be possible to make music and to bring into relation together the shreds of reality in order to tell stories. (Pauli 1971: 41)

Even if certain of the sounds are meant as allusions in *The Fall*, a close eye is kept on Truax's mentions of the quality of the sounds and their perception, described as follows:

(1) Listener recognisability of the source material is maintained, even if it subsequently undergoes transformation;

(2) The listener's knowledge of the environmental and psychological context of the soundscape material is invoked and encouraged to complete the network of meanings ascribed to the music;

(3) The composer's knowledge of the environmental and psychological context of the soundscape material is allowed to influence the shape of the composition

[22] Michael Kott, a classically trained cellist from Santa Fe, New Mexico, USA.

at every level, and ultimately the composition is inseparable from some or all of those aspects of reality;
(4) The work enhances our understanding of the world, and its influence carries over into everyday perceptual habits (Truax in Drever 2002: 22).

The Fall describes metaphorically the trajectory of a meteorite from space to its crashing point on earth, and the sound of the cello is its symbolic representation. Meanwhile, the sound of the trains is the most present timbre of the place and provides a melody to the composition, according to Sacks:

> We tend to add a sort of melody to the sound of a train (there is a wonderful example of this raised to the level of art, in Arthur Honneger's *Pacific 231*) or to hear melodies in mechanical noises. (Sacks 2007: 244)

The trains, the water (the waves from the lake, the movements of the river and the drips from the staircase), and the cello are morphed together. For a moment, the sound of water is kept intact for a balance with the abstracted sounds. The sounds are then grouped together and intended to create new timbres, as suggested by Bergman:

> Simultaneous grouping causes large group of instruments to fuse their effects to produce (in Boulez' words) 'Phantasmagoric' instruments. (Bregman 1999: 489)

The term 'Phantasmagoric' is a metaphor for the abstracted sound in *The Fall.* Boulez mentions fusing the effects of the instruments. In *The Fall* it is the fusion of the sounds and spaces by convolution that creates the 'Phantasmagoric'.
The introduction starts as a flight of the meteor in the space (until 1'05'') with dripping sounds. At 1'05'' the cello begins. The instrument is a metaphor for the meteor itself. These are slow movements and very low. Then at 1'21'' as a counterpoint and contrast to the long sounds of the cello, the sound of the drips is scrambled, giving a fast-paced movement

with very short sounds. The introduction ends at 1’46” and opens on a slower motion area.
The first movement starts with the notes of the cello, which are higher notes than before, and the river recorded with the hydrophone remains until 2’38’’, the cello slightly morphs with the water and the sound of a train arriving at 3’23’’.
The second movement starts at 3’50” with an altered cello, a very low frequency cello and a train modified by convolution. This part is minor and creates alternate layers between train and cello. The cello morphed by convolution with the sound of the train produces a metallic timbre giving glissandi and pizzicato textures to it and continues until 6’12’’.
At 6’12’’ the cello re-appears and once again the scrambled water drips, as in the introduction. The third movement begins with the water recorded by hydrophone.
This is followed by the white noise from the crashing waves from the lake. The envelope of the waves is altered in order to bring movements into the sound. This continues until 7’56’’, when the low frequencies from the cello return and layered with the waves on the lake. At 8’35’’ upper notes from the instrument lead to a final rush until the end of the piece, with the cello and the water finishing smoothly at 10’32’’.

3.1.3.3 Diffusion through Eight Loudspeakers

The choice of eight loudspeakers is aesthetic as a classical form of sound-based diffusion system, relating to the Conservatory, classical music and a classical form of electroacoustic music. In addition, the diffusion through eight channels is also a configuration for an immersive spatial movement around the sculpture. Movements of sounds around the sculpture have the potential to create perceptual disequilibrium as the glass of the polyhedron provides infinites perspectives and therefore disrupts the visitor's self-perception. Hence, the loudspeakers surround the sculpture and provide the audience with an altered state of perception.

For the composition of the sound motion, I used the Zirkonium (ZKM 2009) software from ZKM Karlsruhe, Germany. The eight loudspeakers for the opening were L-Acoustics model 112 HP, coupled with four subwoofer L-Acoustics model SB 15P. This system was chosen for the outdoor nature of the performance, where power and precision were needed and to provide a physical aspect to the piece, in order to *touch* the audience.

3.1.4 Achievement; Conclusions

The direction taken by this work was driven by the idea to consider sound as a material and intended to create a sound sculpture on the basis of plastic considerations emanating from a discussion with a sculptor; *The Fall* then resonates with a real and physical sculpture. Simultaneously, as an eight-channel composition surrounding the audience, the work appears as a sound sensation – a sound body – or, as described by Varese, as sound masses. Convolution emphasises this aspect as a strategy to augment the perception of the locations and therefore develops the idea of the evocation of space as an allusion.

Future investigations include the observation of how perception is triggered by the work and furthermore how it is integrated by the audience in terms of plastic works. In addition, the current work was based on empirical processes developed during conversations; although illustrative proposals emerging from the dialogue with the sculptor are removed to avoid redundancy, compositional rules defining how a sculpture and a composition produce an amplification of artworks will be developed.

De Rerum Natura
Live Electronics Composition

Fig. 3.2.1 Mamori Lake, Amazon Rainforest, Brazil (Forcucci)

Every man should pull a boat over a mountain once in his life –
Werner Herzog

Summary

De Rerum Natura is an electroacoustic composition based on field recordings from the Brazilian Amazon rainforest. The piece explores deep listening[23] both as a procedure and as a method for composition. The approach observes dynamic subjective links between the listening/recording experience of the original material (Real spaces) and the perception by the audience during the performance (Virtual spaces). The diffusion of the sound in the performance space generates dynamics, which become components of the composition. The intrinsic sonic qualities of the venue thus become part of the piece, incorporating the 'colour' of the acoustics of the space[24], and this includes factors of resonance. Ideas about the deterritorialisation of a place and reterritorialisation[25] in the performance space are approached. How is the performer affected by the resonance of the room while s/he plays the piece? How, in return, are the piece and the space influenced by the diffusion? How does the listener experience and feel about the space (Smalley 1996: 91)?

3.2.1. Introduction

De Rerum Natura explores the unique nature of the soundscape from the Brazilian Amazon rainforest. The natural environment is dense in terms of sonorities; it therefore absorbs (meaning that the ears and the mind are fully concentrated and dedicated to listening) and influences the composer while

[23] 'Deep Listening® is a philosophy and practice developed by Pauline Oliveros; it distinguishes the difference between the involuntary nature of hearing and the voluntary, selective nature of listening' (Deep Listening Institute, n.d.).
[24] The 'colour' of the acoustics of the space is a metaphorical view of the reverberation and perception of a space in reference to the German *Klangfarbe* (Randel 2003: 446), *the timbre or* tone colour.
[25] 'Reterritorialisation must not be confused with a return to a primitive or older territoriality: it necessarily implies a set of artifices by which one element, itself deterritorialised, serves as a new territoriality for another, which has lost its territoriality as well' (Deleuze and Guattari 1987: 174).

s/he is soundwalking and looking for a place to record, or during recording. It creates vigorous mental imageries; these are later included in the composition as the first stratum of intention and transmitted to the audience during the performance (reception/perception). Thus, 'to listen is to decode; it is to make sense of a sensory input' (Chare 2009: 254).

This opening Section 3.2.1 introduces the real and virtual spaces from *De Rerum Natura.* The field is discussed through ideas of deterritorialisation, reterritorialisation and Guattari's ideas on ecosophy. Next, strategies of recording in the Amazon rainforest are presented. The section moves towards those composers who include as a component of their works the architecture of the performance space. Section 3.2.2 introduces the context of the development of the project. Considerations regarding the site-specificity of performance and how to document this aspect are proposed. The section ends with three case studies, the locations where the piece was performed. In Section 3.2.3, the concept of composition is introduced through discussing possibilities for the classification of sound. The section continues with the development of the composition. The chapter ends with Section 3.2.4, which concerns achievements and conclusions regarding the piece composed.

3.2.1.1. Mapping of Real and Virtual Spaces

The approach resides in emphasising the listening experience by developing a dynamic link between the Amazon rainforest (Real spaces) and the reception/perception of the audience during the performance (Virtual spaces) of the composition. This is considered through contrasting issues between audio culture and visual culture. According to McLuhan:

> Western man thinks with only one part of his brain and starves the rest of it. By neglecting ear culture, which is too diffuse for the categorical hierarchies of the left side of the brain, he has locked himself into a position where only linear conceptualization is acceptable. (McLuhan in Cox and Warner 2004: 67)

In *De Rerum Natura* the emphasis through deep listening during the recording process allows concentration on the perception of the environment through sound, the main idea being to invigorate a multimodal perception that goes beyond sight. Those issues are investigated in the present work by creating an experience in the performance space where it is received by immersing the audience in full darkness, possibly wearing blindfolds (as proposed by the Spanish composer Francisco López), in order to intensify the listening experience. The context of listening includes ecological issues of a particular environment, then their perception by an audience. Guattari mentions three ecological registers:

> An ethico-political articulation – that I call ecosophy – between the three ecological registers, the one of the environment, the one of the social relations and the one of the human subjectivity.[26] (Guattari 1989: 12)

Therefore, the ecological registers mentioned above appear in *De Rerum Natura* as follows:

(1) The (sonic) environment of the Amazon rainforest is deterritorialised and reterritorialised. It creates a temporary place that is a relation between the performance space and the composition. The reterritorialisation engages the listener in a sonic experience, where several spaces and places from the Amazon rainforest are layered together and recombined within the performance space. They therefore become what Deleuze and Guattari call 'a new territoriality for another' (Deleuze and Guattari 1987: 174) and lead to a sonic *moiré* pattern. The sonic *moiré* is a metaphor of illusional aspects of multiple possible levels of listening, created by the addition of layers of sound in the performance spaces.

[26] 'Une articulation éthico-politique – que je nomme *écosophie* – entre les trois registres écologiques, celui de l'environnement, celui des rapports sociaux et celui de la subjectivité humaine.'

Fig. 3.2.2 Moiré pattern

(2) The social relations are those of the fauna from the Amazon rainforest and their sonic activity in relation to the listener. Attention to the sound of the environment is part of the social relations, and they are required in the Amazonian rainforest for reasons of survival, according to Oliveros:

> Animals are Deep Listeners. When you enter an environment where there are birds, insects or animals, they are listening to you completely. You are received. Your presence may be the difference between life and death for the creatures of the environment. Listening is survival! (Oliveros 2005: xxv)

The composer in the Amazon rainforest pays attention to the environment for reasons of survival. The environment may be hazardous, due to the presence of very dangerous species (in particular, snakes). With this in mind, careful observation during listening and attention develop a tension during the listening experience of the humans and while recording. The listening experience is when the first elements of the composition appear. The tension is imparted into the composition.

(3) Human subjectivity is the perception, by the audience, of the piece and the consecutive interpretation of *De Rerum Natura* by the audience. The resulting mental imageries, triggered by *De Rerum Natura*, are the artworks, too, according to Foucault:

> Transformation of one's self by one's own knowledge is, I think, something rather close to the aesthetic experience. (Foucault 1990: 14)

The transformation of one's self by one's own knowledge in this case relates to the memories that will be triggered by the sound of the Amazon rainforest, even for members of the audience who have never been there, by transferring the impression of the tension in the sound of the rainforest, thus triggering the mental imagery of the audience.

3.2.1.2. Background

The following composers are major influences upon the current work. This is because of their respective ways of integrating the performance space in the composition, both during the diffusion of the sound and by transforming the space itself into an instrument.

- **Edgar Varèse**

The composer is paramount in the idea of projection of sound masses. However, due to technological constraints, he was able to realise properly his sound projection dream only late in his career, with the piece *Poème électronique.* Nevertheless, Varèse anticipated the concept of projection in the performance space as early as in 1936, during a lecture he gave in Santa Fe:

> When new instruments will allow me to write music as I conceive it, the movement of sound masses, of shifting planes, will be clearly perceived in my work, taking the place of the linear counterpoint. When these sound-masses collide, the phenomena of penetration or repulsion will seem to occur. Certain transmutations taking place on certain planes will seem to be projected onto other planes, moving at different speeds and at different angles. There will no longer be the old conception of melody or interplay of melodies. The entire work will be a melodic totality. The entire work will flow as a river flows (…) the role of colour or timbre would be completely changed from being incidental, anecdotal, sensual or picturesque; it would become an agent of delineation, like the different Colors on a map separating different areas, and an integral part of form. These zones would be felt as isolated, and the hitherto unobtainable non-blending (or at least the sensation of non-blending) would become possible. (Varese and Chou 1966: 11,12)

Furthermore, ideas of sound projection can already be observed in his piece *Ionisation* and are articulated as follows:

> By 'projection', I mean the sensation that is given to use by some blocs of sounds. I would say with more happiness 'ray of sound' (…) For the ear as for the eye, this phenomenon gives a sensation of extension, of travel within space.[27] (Castanet in Horodosky and Lalitte 2007: 53)

The transformation of the performance space by projection of sound through strategic placement of loudspeakers relates to *De Rerum Natura* as an integral part of the composition. In addition, the 'transformations themselves are systems that define, at a superior level of abstraction, forms of spatiality' [28] (Granger in Horodosky and Lalitte 2007: 73). The transformation of the acoustic properties of the space in *De Rerum Natura* follows the strategies developed by Varèse:

> Today, with the technical means that exist and are easily adaptable, the differentiation of the various masses and different planes as well as these beams of sound could be made discernible to the listener by means of certain acoustical arrangements (…) In the moving masses you would be conscious of their transmutations when they pass over different layers, when they penetrate certain opacities, or are dilated in certain rarefactions. (Varèse in Risset 2004: 33)

In De Rerum Natura, the transmutation of the sounds exists when projected in the performance space and as such the composition is intrinsically related to it. The composition will then change for each performance according to the acoustic properties of the performance space.

- **Maryanne Amacher**

Her work is of particular interest by integrating the architecture of buildings, specifically with what she called 'structure-borne' sound, meaning the sound

[27] 'Par "projection", j'entends la sensation qui nous est donnée par certains blocs de sons. Je dirais avec plus de bonheur "rayons de son" (…) Pour l'oreille comme pour l'oeil, ce phénomène donne un sentiment de prolongation, de voyage dans l'espace.'
[28] 'Les transformations elles-mêmes constituent des systèmes qui définissent, à un niveau d'abstraction supérieur, des formes de spatialité.'

enters directly in contact with the structure. Although *De Rerum Natura* does not always enter directly into contact with the structure of the buildings where the performance is held the idea that the architecture becomes an instrument is very much present, and according to LaBelle:

> Space can be incorporated into the sculpting of particular sound work: rather than house a work, work can literally become a house. Amacher's 'sound characters' operate to immerse the listener/viewer in a specific narrative of sound and space, as a 'sonic theatre' in which the material function of architecture shifts to that of vibration. (LaBelle 2006: 173)

The performance spaces where the piece is presented are investigated as 'sonic theatre' in *De Rerum Natura*; the composition resonates with the space by creating a call and response. This is accomplished by playing with the resonance of the space. The resonance that LaBelle calls 'vibration' *is* the work. It appears once the sound starts to enter into resonance with the physical architecture, and the work is no longer only the composition *per se,* but the vibration resulting from the interaction of the sound with the architecture of the building.

- **Luigi Nono**

La Fabbrica Illuminata by Nono is of interest for the current project through the idea of the deterritorialisation and reterritorialisation of the meaning in his work. There are many ways to understand the title, and all are political in the case of Nono. The present context of *De Rerum Natura* relates to the idea of transforming a location by offering various angles of listening and providing room for the interpretation of the material. De Benedictis mentions how Nono proposes insights into technology and composition issues, and how to reconfigure venues, which are the main points investigated in *De Rerum Natura*:

> [Nono] viewed technology as a new frontier that allowed him ever freer and more immediate artistic expression, experimenting with solutions involving sound and space (…) the choice of intervals could become increasingly 'intuitive', being defined *in situ* and projected

> onto the juxtaposition or superimposition of complex sound textures (blocs, layers, lines and so on) (…) Being subject to environmental variables involving the projection of sound in space, the influence of microphones and so on (…) The 'space' which the composer imagined – achieved during the eighties by means of the transformation, elaboration and projection in real time of sound made possible by live electronics – was conceived as an environment in which spatial and temporal relationships could form part of a total dimension (…) The whole of Nono's output is based on the pursuit of new sonorities, requiring not only a different manner of experiencing sound (by performers and listeners) but also new configurations for concert venues. (De Benedictis 2013)

The performance space is 'augmented'. It is no longer the space *per se*; rather, it is illuminated through a strategic position of microphones and loudspeakers in such a way that the composition interacts with the performance space itself. It allows an additional layer of spatiality, where the resonance of the performance space is interpenetrated by the illumination of the microphones and loudspeakers.

3.2.2. Context of the Work Itself

Field recordings and deep listening took place during the month of December 2008 at the Mamori Art Lab, a sound lab in the Amazon rainforest of Brazil. The work spanned two weeks, between 6 and 19 December 2008. The recordings were made in the early morning, during the day or at night, during daily expeditions in the deep jungle on foot or by boat. There were no possible communications with the outside world (no Internet or telephone), leading to a deep concentration and immersion in and towards the works, the tasks, and the listenings.

3.2.2.1. Mamori Art Lab

The Mamori Art Lab was a sound research laboratory led by the composer Francisco López. Groups of ten international artists, musicians, and composers worked together, exchanging ideas and concepts during weekly presentations of their respective works, or by informal discussions on sound practice during

the period in the jungle. The workshops allowed and encouraged the development of new skills through constant exchanges of techniques and views on sound material.

3.2.2.2. Documenting A Site-specific Performance

De Rerum Natura is a live electronic; the performance space is always carefully explored, and exploited through strategies (e.g. the number, type and disposition of loudspeakers, and the placement of the audience). In this regard, the field recordings are, as elements of the composition, only one part of the composition. The piece exists solely in the performance space once it is diffused. The documentation relies entirely on the space, the position of the audience, the placement of the loudspeakers, as detailed at Section 3.2.2.3, and a live recording. Still, the last item is not a full experience of the piece, yet only information about the composition and articulation of the piece.

3.2.2.3. On The Influence of The Performance Space, Three Case Studies:

The composition takes its full shape during the performance, in terms of resonance with respect to each performance space of diffusion. The resonance of sound *to* space is a complex relation, including the reception and memory of the listener:

> All the sound presence is so made of complex returns, whose knotting is the resonance or the 'sounding' of the sound, expression that one must hear – hearing and listening – as well on the side of the sound itself, or its emission, as on the side of its reception or listening: it is indeed from one to the other that it sounds.[29] (Nancy 2002: 52)

The influence of the performance spaces is highlighted through the following points:

[29] 'Toute la présence sonore est ainsi faite d'un complexe de renvois dont le nouage est la résonance ou la « sonnance » du son, expression que l'on doit entendre – entendre et écouter – aussi bien du côté du son lui-même, ou de son émission, que du côté de sa réception ou de son écoute: c'est justement de l'une à l'autre qu'il sonne.'

- The composer experiences the resonance of the performance space while diffusing sounds and creates a live loop feedback, an intention and reception/perception at the same time, which Gibson proposes as follows:

  > Instead of supposing that the brain constructs or computes the objective information from a kaleidoscopic inflow of sensations, we may suppose that the orienting of the organs of perception is governed by the brain so that the whole system of input and output resonates to the external information. (Gibson 1966: 5)

  The resonance of the performance space with the sound (as input) is interpreted by the composer and then re-injected (as output) by playing with the diffusion of sound and the resonance. The perception therefore resonates with the performance space;
- The composition changes according to the space and is therefore always different;
- The perception of the performance space's architecture changes according to the sound in the mind of the audience, while listening with eyes closed in order to focus on sound and mental imagery. As a movie for the ears.

Although *De Rerum Natura* includes sounds already composed in the Amazon rainforest[30] and intrinsically site-specific, site-specificity resides in the intention to decontextualise and deterritorialise the space, sound and environment of the Amazon rainforest, then to reterritorialise these in the performance space where the sonic properties of the architecture will respond to 'iconoclastic' material from the rainforest. As a comparison with space, sound and colour, Cendrars mentions that:

[30] An initial version of *De Rerum Natura* was composed in three days on site on my laptop in order to present to the local population the result of the recording sessions.

> A colour is not a colour in itself. It is a colour only in contrast with one or more colours.[31] (Cendrars 1960: 192)

The underlined contrast stated by Cendrars resides in *De Rerum Natura* through these categories:

- Amazonian recorded sounds and the contrast between them within the composition;[32]
- The sound composition and its projection into the performance space and how it illuminates the space (or not);
- The contrast as the subjective reception of each listener: The relation between what is heard and what is imagined, as proposed by Gibson and Pick:

  > Humans, however, have minds that contain mental representations, images, thoughts, and concepts, inner structures that are not observable to the outsider and that direct and intervene in behaviour. (Gibson and Pick 2003: 4)

A language needs to develop in order to make the work understood by the audience, a language that allows the listener to understand the music without being an expert in new music. Dusman says that 'each identification of a cadence reifies that there is some thing to know about this music, that there are some fundamental truths about music that are *the* experiencing of music' (Dusman 1994: 137).

> Why is space included among those things that are illegible? Well, because of its nonroughness. Without separability, there is no extension, no distance. The space of the universe would find itself condensed into a mathematical point without dimensions. Indeed, Parmenides Being, which fills all space and eternity, would be nothing but an absolutely smooth 'mathematical point'. (Xenakis and Brown 1989: 88)

[31] 'Une couleur n'est pas une couleur en soi. Elle n'est couleur qu'en contraste avec une ou plusieurs autres couleurs.'

[32] The sounds from different situations (open spaces, underwater, and into the jungle) are put together in layers. It gives rise to an artificial space.

Following the Xenakis metaphor, a difficulty arises in a representational space. How to transform the performance space? How to change the perception of the performance space by the audience? What is the influence of the performance space on the performance of the piece?

De Rerum Natura investigates the notion of embodiment of the performance space by the perception of sound through the body. Three case studies are proposed for different settings for the audience and with different acoustic strategies:

a) Galpao Cine Orto, Belo Horizonte, Brazil

Concert on 21 August 2009.

The Galpao Cine Orto is an old cinema from the 1920s transformed into a theatre. The audience sits in front of the proscenium. There is no light during the performance. The set-up includes two microphones positioned on the sides of the venue (left and right) in order to capture the room's sound live and to send it back to the PA system (controlled by the composer), creating a loop feedback. Thus, the performance space is integrated live into the composition. The PA is a quadraphonic system: two loudspeakers are at the front, and two rear loudspeakers sit behind the audience.

Fig. 3.2.3 Galpao Cine Orto, view from audience

Fig. 3.2.4 Galpao Cine Orto, view from stage

While the side microphones capture the sound, the audience experiences a double perception of the performance space: the first is the illumination of the space by the diffusion of the composition, which the side microphones capture then subsequently re-inject into the performance space, with a small delay, through the rear loudspeakers, for the second perception.

b) Le Bourg, Lausanne, Switzerland

Concert on 13 November 2009.

Le Bourg is an old cinema transformed into a concert venue. Its main difference from the Galpao Cine Orto theatre lies in Le Bourg's absorption of sound by a layer of carpet on the walls. The audience sits on chairs and sofas. There is no light during the performance, apart from candles on a table. The PA is stereo, controlled by a sound engineer. The basses from the composition (sixty Hz on the PA) are pushed to their limit. Then, the structure of the building vibrates, creating an embodiment of the sound and the space for the audience. The sound of the vibrations is perceptible on the recording, and thus supports this theoretical writing.

Fig. 3.2.5 Le Bourg, view from above

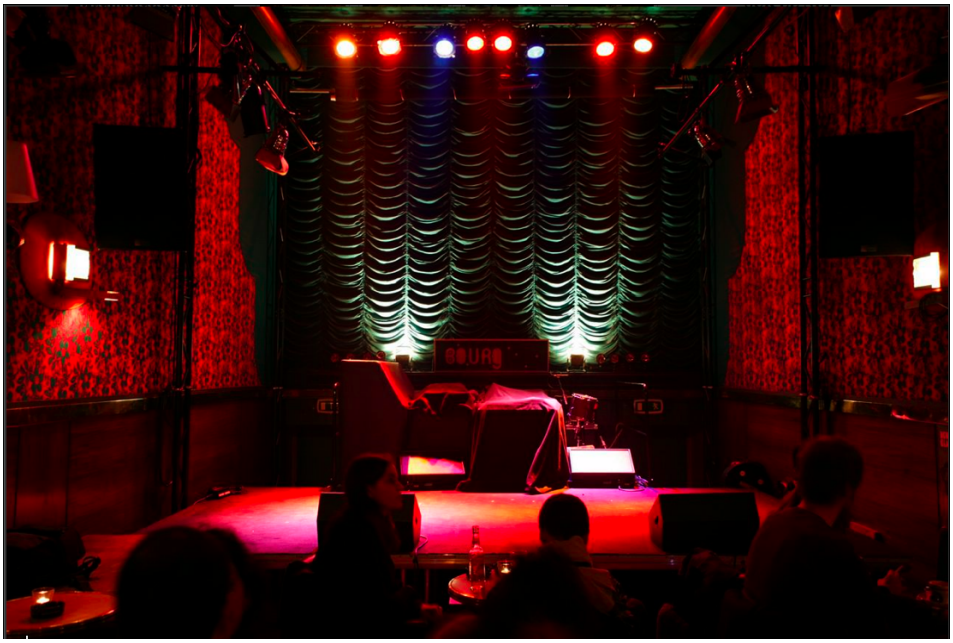

Fig. 3.2.6 Le Bourg, view from the audience

c) Museum of Fine Arts, La Chaux-de-Fonds, Switzerland

Concert on 14 November 2009.

The performance space is a room in the museum, a square of twenty metres per side and four metres in height. The walls are made of concrete, creating a reverberation time of four seconds. The audience sits on deck chairs or lies on mattresses placed randomly within the space. The sound system surrounds the

audience with eight loudspeakers in a circle and two subwoofers. The performer stands at the centre of the circle. During the concert the audience is immersed in full darkness. The surrounding system and the resonant properties of the room create an embodiment of the sound.

Fig. 3.2.7 Museum of Fine Arts, panoramic view of the room (Pfiffner)

Fig. 3.2.8 Museum of Fine Arts, view of the room with deck chairs (Pfiffner)

3.2.3. Composition

The first traces of the composition emerged in the composer's mind while he was soundwalking in the rainforest and during recording sessions while deep listening. The Amazon rainforest is so remote that telecommunications are impossible, thus one concentrates only on the recording task and with absolute dedication. The dedication is so intense that the sounds are deeply engraved into the mind. The powerful images created by the sonic environment while recording create the first mental

images for the composer. Those are the seeds of the composition and the initial dramaturgy. Here are a few examples:

- The dolphins recorded with the hydrophones;
- The bats recorded with ultrasonic microphones;
- The frogs recorded during the night;
- The tension while walking into the rainforest and avoiding snakes;
- Deep listening to the rainforest while recording;
- The multiple eyes in the dark illuminated by the torch, which are those of alligators.

De Rerum Natura exists once it is diffused and when the sounds dynamically incorporate the performance space each time the composition is presented, in line with Windsor's proposal:

> The motivation for adopting an ecological approach in this context is to redress the balance between abstract approach to musical structures and those that take into account the connections between sounds and the environment that produces them. (Windsor in Emmerson 2003: 13)

Accordingly, Ligeti reinforces this vision by comparing the composition to a picture, and by suggesting that the nature of the relation of sound and space is similar to that of colours and surfaces:

> That is the seeming conversation of temporal relations into spatial ones. The course of the form is no longer experienced as a 'process of congestion and relaxation, but as a juxtaposition of colors and surfaces, just as in a picture. (Ligeti 1975: 15)

De Rerum Natura is precisely the result of a first deterritorialisation of the sonic environment from the Amazon rainforest into the composer's mind, and reterritorialised into the performance space as for the *moiré* example proposed in Section 3.2.1.1. It relates to the picture proposed by Ligeti as the juxtaposition of colours and surfaces, in which, in the current examples, colours and surfaces are a metaphor for sound and space. The

soundscapes are projected into the performance space; their juxtaposition leads to the moiré pattern.

The idea of manipulating such already rich material is to register the presence of the composer through a reappropriation and a reterritorialisation of the sound, both live and in a studio,[33] in addition to the diffusion strategies as mentioned in Section 3.2.2.3.

De Rerum Natura includes Emmerson's grid issues on abstracted syntax, and a combination of aural and mimetic discourse (Emmerson in McCartney 2000: 11 and Truax 2002: 7). The combination includes field recordings and manipulation of rich material from the rainforest.[34]

Hence, the natural soundscape may even appear as industrial machinery after manipulation (according to the data questionnaire from the current research in Section 5.2.2.).

There is a shift from a lofi (urban) and hifi (nature) categorisation (Schafer in Cox and Warner 2004: 29-38) to a broader notion evoking multiple possible fields of interpretation and listening.

The recording strategies, the classification and the live manipulation of the material in the performance space, as well as the technology that allows the manipulation of big sections of material live, lead to an evolution of a language and form of soundscape composition.

3.2.3.1. Field Recording Strategies

The positioning of the recording equipment in the Amazon rainforest includes a sonic appreciation of the location. Regrettably, the recordings of wildlife suffer from our human presence. Therefore, three main recording strategies are defined:

- Set up the equipment and wait for thirty minutes at five hundred metres' distance – at least. While waiting, avoid any noise, in order to let nature

[33] It is done by convolution between sounds, equalisation or bit reduction (i.e. from twenty-four bits to four bits).

[34] The sounds are from the rainforest (mimetic) and are sometimes abstracted electronically.

forget the human presence, and then deep listening among those waiting happens;
- Arrive by boat (pirogue) on location and set up the equipment, (hydrophone or shotgun microphones); wait for thirty minutes; deep listening takes place as well;
- Set up the recording equipment and go back to the base camp for two hours, leaving the equipment on location. Deep listening is included while walking back.

The waiting period while recording and careful listening increase the visual and sonic memories of the composer; those memories are the initial elements of the future composition. The recording method follows precise steps in order to find the best locations, carefully listening to them and avoiding human presence. 'Carefully listening' to the locations means:

- To observe the environment and its acoustics (e.g. leaves, forest, open space, water, dry vs. wet environment);
- To observe the diversity of the sound of the fauna (e.g. monkeys, insects, birds, frogs) as a component;
- The composer immerses him/herself in deep listening.

Emmerson proposes space and perspective as materials for composition:

> Space itself can 'tell a story'. A sense of space, of being and existing (…) space and perspective are now truly materials with which we can compose. (Emmerson 2007: 102)

The space therefore becomes what Deleuze and Guattari call 'a new territoriality for another' (Deleuze and Guattari 1987: 174) and leads to a sonic *moiré* pattern. The sonic *moiré* is a metaphor for the illusional aspects of multiple possible levels of listening, created by the addition of layers of sound in the mind of the composer, a polyphony of spaces. It is also a memory of space related to a mental imprint incrusted during the deep listening sessions into the Amazonian Rainforest. The imprint in the present context is the story the space tells according to Emmerson's proposal and is included during the process of field recordings and in the mind of the composer. In addition, Tsabary proposes:

> The practice of deep listening is concerned primarily with sound as a means for heightened environmental and awareness, devoid of analytical thought processes. (Tsabary 2009: 301)

Therefore, the memory of the Amazonian Rainforest as a first layer of composition appears during the deep listening sessions, by a full dedication (*heightened environmental and awareness*) to the perception of the space and without analysing the process.

3.2.3.2. Classification

During the compositional period in the studio, which spanned over six months, the classification of sounds was the first and most intensive task of all. The material is so dense that recordings encapsulate layers of very rich and complex sounds, pitches and timbres; it gives a multi-level and multi-layered perspective of listening during the studio session, not to mention the sonic memory of the travel (the subjective space). Each recorded location contains many sounds from the fauna (e.g. monkey, insects, birds, frogs) and the sonic reflection of the environment (e.g. on leaves or water). The sound is very rich and complex in term of timbre and frequency of the sonic events, which in turn, is linked to the idea of '*spatial fill* – how sparsely or densely populated the space is' (Smalley 1997: 124).

Forty hours of sonic material were recorded during the expedition. The intensive listening and classification of the material require high concentration. The classification is done by:

- Timbre;[35]
- Density;[36]
- Nature of the sounds (e.g. dolphins and bats use echolocation through their sonar).

[35] The timbre in this situation is subjective and relates to the past recording experience in the Amazon rainforest: the experience is already part of the compositional process, where the 'colours' (*Klangfarbe*) of the sound and of the space/place of recording are qualified as 'timbral'.
[36] The density is related to the contrast between sonic phenomena and the number of 'layers' contained within a sound.

The recorded sounds are the following:

- Frogs at night;
- Insects at night and day;
- Birds during the day;
- Monkeys at night and day;
- Bats at night;
- Dolphins and underwater activity during the day;
- Human activity night and day;
- Rain and thunder night and day.

There is no precise canvas of the future composition during the recording period in the rainforest; instead, there is a focus on the different sonic specificities of the recorded environments and how one moves inside those environments. During the composition process the goal is to confront the material by convolution, by addition of layers or by comparison. The idea of comparison suggests that one needs to classify sounds with a similar timbre, play them together and listen to how they fit together.

3.2.3.3. Development of the Composition

De Rerum Natura evokes a voyage through an unknown imaginary territory. The movements of the piece are balanced between real and unreal sounds, giving rise to powerful subjective images. The expedition was a particular and unique experience: it showed the contrast between initially arriving in the jungle with the daily urban stress then quickly relaxing and forgetting everything outside. The experience was like floating between reality and a dreamy state, a kind of unplugged or disconnected impression.

Movements are the core structure of the piece. However, the time line (below) relates to the recording accompanying this report. As mentioned before, the composition is a function of the performance space and as a live electronic construction its length may vary, yet the movements stay.

1. First Movement: 0’ Earth and Birds;
2. Second movement: 7’07’’ Rain;
3. Third movement: 10’34’’ Water under resonators;
4. Fourth movement: 13’ Convolution between waters;
5. Fifth movement: 17’ Bats, birds and dolphins;
6. Sixth movement: 24’ Water convoluted with bats;
7. Seventh movement: 26’ Decimated frogs,[37] normal frogs, bats and water;
8. Eight movements: 37’42’’ walk into the forest.

The movements include real and artificial sounds, in order to provide a balance between two entities, both concrete identifiable and subjective realities in the mind of the listener. As proposed by Luc Ferrari:

> To recognize the sonic sources equalled in my conception to a surrealist collage, meaning to make a succession recognizable noises and not recognizable invented noises, as a surrealist poem, where one can see juxtaposed a sentence sourced as a citation and an invented word.[38] (Gayou 2001: 29)

On the other hand, the idea of movements includes the idea of a sonic continuum, with almost no silences, where the sound is progressively metamorphosed. Those movements describe, structurally, sound masses, although not events as proposed by Alla writing about Tristan Murail:

> Since its first works, Murail thinks of each composition as a continuous sound slowly metamorphosing. Inherited from the orchestral works of Ligeti like *Atmosphère* (1961) and *Lontano* (1967) or Xenakis’s *Metastasis* (1953-54) and *Pithoprakta* (1955-56), the composer thinks of sound masses and not of events.[39] (Alla 2008: 254)

[37] Decimated frogs, means sound reduction from twenty-four bits to four bits (in relation to Tom Erbe’s pluggin *Decimate*).
[38] ‘Reconnaître les sources sonores équivalait dans ma conception au collage surréaliste, c’est-à-dire faire se succèder des bruits reconnaissables et des bruits inventés non reconnaissables, comme dans un poème surréaliste, où l’on pouvait voir juxtaposés, une phrase saisie quelque part comme une citation et un mot inventé.’
[39] ‘Dès ses premières oeuvres, Murail pense toute composition comme un son continu se métamorphosant peu à peu. Hérité des oeuvres orchestrales de Ligeti comme *Atmosphère*

Although Murail's work progressively transforms a sound along the composition, this notion is integrated into *De Rerum Natura* inside each movement. Further, the performance space is progressively transformed by the sound diffusion. The greater is the reverberation into a space, the greater the play with silences and resonances.

3.2.4. Achievements; Conclusions

De Rerum Natura's key achievement was an experience of deep listening during field recording in the Amazon rainforest, and how this powerful experience created the elements for the composition. The composition started to emerge in the mind of the composer while he was listening to the sounds and experiencing the different spaces of the forest; also, a link was and is established between the deep listening experience, and the sonic material perceived by the audience. The composer/listener experiences the link during the performance, which is a loop feedback between the space, listening, and memory. The sonic perception of the composition is the result of an addition of rich sounds and spaces from the Amazon rainforest projected into spaces of performance with different specific acoustic characteristics. A metaphorical sonic *moiré* pattern emerges from the following strategies in the selected performance spaces:

- The audience of the Galpao Cine Orto in Belo Horizonte, Brazil, was sitting in the middle of a quadraphonic PA in full darkness. Two microphones captured the room live and re-injected the sound. The composition illuminated the theatre and the sound captured (and live re-injected) by the microphones was slightly delayed in time, thus the composition was the result of two combined spaces.
- Due to the sonic insulation of the theatre Le Bourg in Lausanne, Switzerland, the energy of the heavy basses that were boosted to 60hz on the stereo PA made the structure of the building vibrate. In this case the composition was the result of an addition of the sound emerging from the PA and a physical embodiment of the space created by the vibrations

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(1961) et *Lontano* (1967) ou de Xenakis comme *Metastasis* (1953-54) et *Pithoprakta* (1955-56), le compositeur pense en masses sonores et non en événements.'

of the structure of the building. The audience was sitting in front of the PA in the dark, with a few candles on the tables.

- At the Museum of Fine Arts in La Chaux-de-Fonds, in Switzerland, the audience, while lying in deck chairs or on mattresses on the floor, experienced the high resonance of the concrete walls of the museum. Furthermore, eight loudspeakers in circle and two subwoofers in front of the performer surrounded the audience, so that the space was perceived through the movement of the sound through the loudspeakers and the 'answer' of the long resonance of the performance space.

The conceptual idea of the sonic *moiré* is an auditory perception of multiple layers leading to an illusional pattern, comparable to that which emerges visually from the Rotoreliefs of Marcel Duchamp that he calls 'non-retinal art', as something happening between the work and the viewer; in the current example, it takes place between the work and the listener. Therefore, the sonic *moiré* pattern changes according to the nature of the spaces of each performance. In that sense, the characteristics of the performance space have been amplified by the piece. The improvement for future compositions in the context of deep listening will be to explore the dramaturgy during the recording process, meaning how one perceives it and develops it while deep listening. Finally, the perception of the spaces of the Amazon rainforest as amplified by the performance spaces is also perceived through the embodiment of the sound. This is true for the audience and the composer/listener/performer, who is included (during the performance) in a loop feedback of memory, auditory perception, and space perception.

My Extra Personal Space
Stereo Fixed-medium Composition

Fig. 3.3.1 Paris and Normandy Coast (Forcucci)

Caminantes, No hay caminos, hay que caminar.
Pilgrim, there are no paths, you must walk –
Medieval Inscription on a Monastery Wall in San Francisco de Toledo, Spain

[The Aleph] contains in its inarticulable shape all the relations with the universe and it is, ultimately, the universe itself – J.L. Borges

Summary

My Extra Personal Space is a stereo fixed-medium piece exploring convergences of timbres from antagonist soundscapes, which are natural and urban contexts from the Normandy coast and from Paris, France. The piece includes soundwalking as an important component and tool to investigate, listen to and compose with the environment. Moreover, walking is approached as an art form *per se* for territorial and sonic exploration. The piece pays a tribute to urban drift of the Baudelairean *flâneur* – the casual wanderer, reporter, and observer in the city – and relies on insights into psychogeography[40] emitted by Guy Debord on the perception of Paris. Here, it extends to nature on the Normandy coast. The piece relates to real and virtual spaces on the map of the project.

3.3.1. Introduction

The project explores the idea of combining timbres from urban and natural soundscapes to create a coherent whole. That is relatively close to acoustic ecology, since *My Extra Personal Space* relies on the idea of the acoustic environment as a musical composition *per se*. The approach is different because the locations are, in the final composition, not recognisable through a specific sonic identity[41], as a clear reference to Paris or the Normandy coast is not provided. The emphasis is laid on the experience of the listener/composer

[40] 'The study of precise laws and specific effects of the geographical environment, consciously organised or not, of the emotions and behaviour of individuals' (Debord in Bauder and Engel-Di Mauro 2008: 23).
[41] '[I]t is equally recognised in acoustic ecology that a major identity marker is the local soundscape' (Järviluoma *et al.* in Johnson 2009: 17).

within those environments and how such experience is recombined into the composition then later perceived by the audience.

My Extra Personal Space refers to the work of 'the Italian Futurists (first Ballila Pratella, then Luigi Russolo) [which] advanced the suggestion that new music could be based on turning the noises of the world into music' (Battier 2007: 189). In addition, the piece relates to the sound object as detached from its original 'milieu', thus is therefore closer to the Parisian school of Pierre Schaeffer than to the Canadian one of Raymond Murray Schafer.

Our soundscape perception changes depending on a rural or an urban situation, as described by Schafer: 'The transition from rural to urban life can be characterised generally as a passage from the hi-fi to the lo-fi soundscape' (Schafer 1976: 6). *My Extra Personal Space* is in stark contrast with a strict lo-fi and hi-fi categorisation of sound as proposed by Schafer (1994) in its positing that such radical segregation is arguable. Instead, the project requires the presence of lo-fi and hi-fi categories in urban *and* natural environments as noise characteristics. In an interview with Bailly, the biologist and composer Francisco López 'states that noise is just as much a component of nature as it is of the urban environment; that the rain forest is as saturated with audio information as [are] vital intersections in major cities' (Bailey 2009: 11). Accordingly, noise pollution is actually an issue in our societies in terms of sound perception, 'a semantic ambiguity', as pointed out by Fontana:

> The world of everyday sound is full of semantic ambiguity. Most people approach this experience without recognising patterns in everyday sound. Noise is the resulting interpretation given to the normal experience of unsemanticised sounds. The semantic ambiguity of sound will change when society develops a capacity to perceive patterns or qualities that are recognizable as part of a context of meaning, such as the sound vocabularies of contemporary music and acoustic art. (Fontana, n.d.)

In *My Extra Personal Space,* patterns of soundscapes and noise are repeated through the composition, and sounds of nature are combined with those from the city. It should lead to the possibility of more clearly recognising and

perceiving in the ambiguity of sound vocabularies of contemporary music in electroacoustic contexts.

Section 3.3.1 introduces the mapping of real and virtual spaces; it does so by observing the acoustic characteristics and properties of sound in relation to listening and perception. The section moves forward to natural and urban soundscapes observed through phenomenology. Influential works contextualising urban and natural issues from the perspectives of such artists and composers as Bill Fontana, Jean-Claude Risset, Luc Ferrari, Luciano Berio, Bruno Maderna and Walter Ruttmann are proposed. The section ends with soundwalking and psychogeography as tools through which to explore, listen to and record territories for composition. Section 3.3.2 introduces how the research was conducted at GRM / INA (Groupe de Recherches Musicales / Institut National d'Audiovisuel) and documented by French National Library François Mittérand in Paris; also, it explains why such a research group was important in *My Extra Personal Space.* The section continues by proposing walking as an art form and how serendipity is included in the process of the soundwalker. Section 3.3.3 introduces the methods of composition through a cinematographic approach, the collection of sound in relation to locations and the classification of sounds. The section ends by introducing the GRM tools, by revealing the structure of the piece and by introducing patterns of sounds in relation to audience perception. Section 3.3.4 concludes the chapter by describing the achievements involving urban and natural contexts when proposing the idea of soundscape as a sound object; the observation of the environment through cinematographic methods; psychogeographical approaches, including the author's and the audience's perceptions; lo-fi and hi-fi issues of sound in compositional contexts, and future research into areas of the perception of electroacoustic works.

3.3.1.1. Mapping Real Spaces and Virtual Spaces

The recorded spaces have been chosen for their acoustic properties, and the sounds for their timbral characteristics. The relation of space to sound in *My Extra Personal Space* echoes Luigi Nono's investigations, as proposed by Pape:

> His sensitivity to composing in the multi-directional, multi-listening possibility of acoustic space, his curiosity about the nature of sound itself, especially what happens to sound at the extremes of listening, very loud sounds or near silent sounds, the perceptual relations between dynamics, time, space, timbre, etc. (Pape 1999: 10)

Nono's position dwells in the multi-listening possibility of the acoustic space, and the perceptual relationships between dynamics, time, space and timbre as these occur within a concert situation; the same sonic issues apply to *My Extra Personal Space* during recording procedures, rather than in the concert situations in Nono.

My Extra Personal Space relates to the contextual map as a composition that straddles the boundaries between real and virtual spaces. The real spaces are recorded *during* a soundwalk. The virtual spaces are the consequential perceived constructed spaces *emanating from* the composition. The intention is to suggest the perception of urban environments as confronted in a continuous flux with natural environments, and *vice versa*.

3.3.1.2. Natural and Urban Soundscapes

The project investigates the evolution of and contrast between natural and urban sounds in relation to the recording locations. Such an evolution occurs not as if it were a progression from natural to urban; rather, there is a constant flux and comparison between them. Accordingly, Cox insists on the phenomenology of sound:

> Phenomenology attempts to 'reduce' (separate or distil) signal from source, and to restrict itself to describing the differences among sounds themselves. (Cox and Warner 2004: 76)

The investigation focuses on the recording as a means towards reduced listening to the soundscapes. It thus becomes the abstraction from its original context and the observation of the soundscape *per se*.

My Extra Personal Space also includes highlighted listening. This means that instead of reducing the sound to an abstracted portion of a whole, it proposes soundscape as a sound object at a macro-level in including its own context. Therefore, listening to the recording includes a constant movement between macro- and micro-levels. The superimposition of urban and natural soundscapes are approached as townscape, as proposed by Thomas:

> Townscape has been translated into a more complex composition (Jacques Lejeune, Luc Ferrari, Evelyne Gayou). For example, superimposing several pictures, several spaces, mixing the spots, bringing in flashes of the 'artificial': in brief, letting the composing show – just as a town perhaps also rewrites nature? (Thomas 2007: 263)

The superimposition of soundscapes, noises, and spaces recorded in Paris with those recorded on the Normandy coast develops an artificial reality and indeed a rewriting of nature by the city through blending them together.

3.3.1.3. Background

The following artists' and composers' works influenced *My Extra Personal Space*:

- **Bill Fontana's *Sound Island***

  The natural white noise of the sea off a rugged cliff on France's Normandy coast was transmitted live, via underwater hydrophones and microphones, to hidden loudspeakers on the facade of the Arc de Triomphe. The sound of waves crashing against rocks masked the loud traffic noise of the immense roadway around the monument and provided a new and unexpected sense of place, time, memory and dimension. (Fontana 1996)

My Extra Personal Space relates to Paris and to the Normandy coast, as in Fontana's work. While the Normandy coast is transmitted live in Paris in

Fontana's work, *My Extra Personal Space* is a process including a soundwalk into the environment, the recording and the composition.

- **Bill Fontana's River Sounding**

The installation is based on collection of sound on the shore of the Thames River and recombined at Somerset House in London. The connection with *My Extra Personal Space* resides in deep listening to locations as the main component of composition:

> I wanted to document moments of listening. I came to regard the act of listening as a way of making music. I regarded it as a creative activity – finding music in the environment around me. (Fontana in Wyse 2010)

The moment when the landscape is listened to is the moment when the first traces of the composition are engraved upon the memory of the composer.

- **Jean-Claude Risset's *Sud***

The influence relies on the transformation of real landscapes into virtual ones through synthesis to unite antagonistic materials:

> Cézanne wanted 'to unify the women's curves to shoulder's hills': Indeed, cross synthesis allows work 'in the very bone of nature' (Michaux), to produce hybrids, chimeras – of birds and of steel, of sea and of wood. I have resorted mainly to transposing profiles, flows of energy. So, the pulse of sea recordings is applied in some place to other sound materials – while at other moments the origin of the 'waves' or welters has no relation to the sea.'[42] (CIRM 2009)

My Extra Personal Space includes a synthesis for the transformation of material in order to create transitional moments, which are detailed in Section 3.3.3.

[42] 'Cézanne voulait "unir des courbes de femmes à des épaules de collines": de même, la synthèse croisée permet de travailler "dans l'os même de la nature" (Michaux), de produire des hybrides, des chimères – d'oiseaux et de métal, de mer et de bois. J'y ai eu recours surtout pour transposer des profils, des flux d'énergie. Ainsi la pulsation d'enregistrements de mer est par endroit appliquée à d'autres matières sonores – alors qu'à d'autres moments l'origine de "vagues" ou déferlements sonores n'a aucune parenté avec la mer.'

- **Luc Ferrari's *Presque Rien* series**

The pieces are influential in their approach using the sonic perspectives of landscape and their 'evolution' (e.g. while the dawn arrives in *Presque Rien n°1).* During an interview with Brunhild Ferrari in the spring of 2010 at the studio Post-Billing of Luc Ferrari in Paris, she answered as follows about the recording process of the *Presque Rien Series:*

Luca Forcucci: How did Luc Ferrari anticipate his recording sessions?
Brunhild Ferrari: His ideas were prepared beforehand. For *Presque Rien n°1* there were no movements, the microphone was on the ledge. He recorded the cicadas from another location, since there were no cicadas in the village. Also, at the end of the piece, a woman sings while swimming, and it was taken in another location of the bay. Otherwise, the entire recording was made at the same place.
For *Presque Rien n°4, La Remontée du Village*, there is the quest for a journey; the village was discovered during the recordings, although he had prepared the idea of wandering around before. There was the wish to discover the life of the village: the people speaking, the children, listening to the spaces of life. The social side was paramount in Ferrari, almost as strong as the sonorous. At some point he had considered himself a (n) (amateur) journalist who transcribed the society. When I mention the social aspect that interested him, it was also the *sound* in the social. When he heard a language he didn't understand, he always managed to get something, because you always understand something through the tone, the facial expression, the hesitation, and the affirmation.

LF: How did he choose the locations for Presque Rien*?*
BF: For Vella Luca (*Presque Rien n°1's* village), he wanted a kind of movie shot. He was very much inspired by cinema and he referred to it. Luc was inspired by how directors were using the camera, like *Fenêtre sur Cour (Hitchcock)* or the movies by Sokourov, in particular *La Pierre,* which has only two shots in one hour.

The cinematographic aspect proposed by Brunhild Ferrari regarding the work of Luc Ferrari in the *Presque Rien* series is a major inspiration for *My Extra Personal Space*: the wandering in the city of Paris and on the Normandy coast was intended to explore locations where the sound would be recorded like a movie shot. *Musique concrète* has a link with movies and is thus described by the cinematographer Jean Epstein and reported by Battier as follows:

> The technique of recording and of montage, which is associated with

> cinematographic practice, came to serve as the substrate of *musique concrète*. (…) The filmmaker, one can say, had already imagined that 'through the transposition of natural sounds, it becomes possible to create chords and dissonances, melodies and symphonies of noise, which are a new and specifically cinematographic music.' (Battier 2007: 191,192)

In *My Extra Personal Space,* the techniques of recording and of montage are at the core of the compositional method. During the field recording, a first cast of the composition is inscribed in the composer's mind as a memory of the recorded location, which, during the montage, serves in the transposition of the sounds and the final composition. Thus, the inspiration of Ferrari's work in *My Extra Personal Space* relates to the analogy with cinema and *static shots* while recording. Regarding cinematographic ideas, two other compositions are of particular interest:

- **Luciano Berio and Bruno Maderna's *Ritratto di Città***

  > The composition depicts the city of Milan with mostly 'voices, sounds noises and short musical pieces' (…) *Ritratto di Città* is one of the first Italian experiments in the field of musique concrète and electronic music – the former is based on the processing of ambient sounds and noises on magnetic tape; the latter relies on synthesized material, that is, sounds that are artificially produced by electronic devices. (Scalfaro 2013)

The difference with *My Extra Personal Space* resides in the use of voices, while sounds from the surroundings, sometimes transformed and synthesised material, relates back to it. On the other hand, the title of the piece, *Ritratto di Città,* can be translated as *Portrait of a City*, so there is the wish to provide an identity since 'the composition depicts the city of Milan', whereas in *My Extra Personal Space*, there is no distinctive relation to the city of Paris. The city remains abstracted. The main point of convergence relies on the conceptual use of the city as material for composition in *musique concrète.*

- **Walter Ruttmann's *Wochenende*[43]**

  In 1928, the German experimental filmmaker Walter Ruttmann was invited to create works for radio. He created *Weekend,* which was a movie without images, a discontinuous narrative based on the mental images projected by the sounds alone. (Wilson 2002: 499)

It relates to *My Extra Personal Space* in proposing a composition as a movie for the ears, which intends to trigger mental imagery. The current project emphasises the imagery by including elements self-referencing to the auditor (e.g. footsteps on pebbles) and generates an impression of a long walk (a tracking shot, in cinematographic terms) through the composition, which links the different shots and sequences as a discontinuous narrative, and is the compositional aesthetic of the piece.

3.3.1.4. Soundwalking and Psychogeography

The French word *dérive* translates as *drift* in English and relates, in the present context, to the exploration of Paris through Debord's psychogeography. It is extended to include the nature of the environment of the village of Etretat:

> In a *dérive* one or more persons during a certain period drop their usual motives for work and action, their relations, their work and leisure activities, and let themselves be drawn by the attractions of the terrain and the encounters they find there. The element of chance is less determinant than one might think: from the *dérive* point of view cities have a psychogeographical relief, with constant currents, fixed points and vortexes which strongly discourage entry or exit from certain zones. (Debord in Butler 2006: 893)

The drift is the exploration of the city without preliminary plans, although in *My Extra Personal Space* the drift includes a soundwalk. The drift, and especially in Paris, has a strong link with the Baudelarian *flâneur* – the wanderer:

> Free from the pressures of the workaday world, he sought the random encounters that the city streets were always ready to offer. (O'Rourke 2013: 8)

[43] Weekend.

Exploring the territory through soundwalk, detached from the visual world, reveals different aspects, according to McCartney:

> A soundwalker's engagement with the landscape is at once sonic, tactile, and kinaesthetic. It is defined through what is heard of others' sounds, through interactions with the surroundings, and by the recordist's own movements. Amplification translates the subtlety of touch into an audible play with surfaces and textures. In soundscape work, traces of tactility are embedded that help to link distant and everyday places. They explore auditory experiences and memories of natural and urban environments, and attend to and reflect upon the depth of daily rituals. (McCartney 2004: 185)

While walking, the sonic experience is encrusted into the composer's mind and memory. Therefore, the moment of the collection of the sounds might be already a compositional act; it describes a relationship between *what* is recorded, and *why* and *how* it is inscribed into the *memory* of the composer. The relation between the field recordings and the composition relies on the memory of the location as experienced during the recording process, as well as how this experience affects the composer and is transferred into the composition.

This introduction highlights the following key points for the composition process in *My Extra Personal Space*:

- The cinematographic aspects of *musique concrète*, which include movement between the macro- and micro-aspects of sound, perspectives in recording, travelling (the movement of the camera/microphone) and the technique of recording and of montage;
- Self-referencing elements such as footsteps in order to emphasise both the fact that it is a movie for the ears and the mental imagery of the listener;
- Deep listening while recording leading to the first traces of the composition in the memory of the author;
- Noise presence in nature as well as in urban contexts;

- Psychogeography applied to the urban environment as well as to nature.

3.3.2. Context of the Work Itself

The project is informed by fieldwork conducted from January to June 2010 in Paris at the GRM / INA (Groupe de Recherches Musicales / Institut National d'Audiovisuel) and with documentation provided by the French National Library François Mittérand in Paris. *My Extra Personal Space* was composed at the GRM / INA studios of Radio France. The research was developed while in residency at the Cité Internationale des Arts (atelier *Le Corbusier*). Regular meetings with Evelyne Gayou[44] and other members of the GRM / INA, such as François Bayle, Director from 1966-1997, Daniel Teruggi, then Director, and Brunhild Ferrari, widow of Luc Ferrari, helped me better to understand the context of works based on *musique concrète*. '*Musique concrète* was defined in 1948 and the GRM created in 1958' (Gayou 2008). Radio shows were recorded on shellac discs; as each ended, a continuous loop held the needle in place. The story goes that, one day, a studio technician went for lunch and left the record spinning. Pierre Schaeffer was in the room and listened to the successive sonic loop for a long time. The sound object was born, a sound removed from its original context, and perceived through reduced listening:

> This was one of the first accidents that caught the attention of Pierre Schaeffer at the beginning of 1948 (…) In fact, what is interesting about these loops is not only that the accident may loop a sound at an unexpected point, but also that it generates a repetition: a short sound fragment (up to one second) that repeats 'eternally' with no variation but produces a rhythmic pattern. (Teruggi 2007: 213)

The observation of the eternal repetition was the birth of the idea of the sound object.

[44] Evelyne Gayou has been a member of the GRM / INA since 1975, a scholar, composer, and radio producer, in charge of the 'paper' editions of GRM. She is also the author of 'GRM: Le Groupe de Recherches Musicales, Cinquante Ans d'Histoire'.

3.3.2.1. GRM / INA (Groupe de Recherches Musicales / Institut National d'Audiovisuel)

Pierre Schaeffer has sustained the development of theory about the sound object and *musique concrète* (Schaeffer 1966), although the Italian Futurists and John Cage had already explored the field before. The current research conducted at the INA / GRM provided insights into nature of sound, noise, sound objects and their perception, as proposed by Battier:

> Electroacoustic composition, which was the basis of the Paris School, followed the contours of historical contingencies: technological evolution, relations to the public, co-operation with the leading institutions (…) The sound object, which may be any possible audible sound, is that which ranges from natural sounds to the noises of civilisation (…) *Musique concrète* was to be founded on the hypothesis that there exists a domain 'beyond the sounds': it is by recording 'the noises of things', and then by the operation of capturing sounds through a microphone, that we can attain it. (Battier 2007: 189, 190, 192)

The idea of the 'perception of sound' linked to the idea 'that there exists a domain beyond the sounds' is paramount not only in the current piece; it is the main idea underpinning the present research. How can the sounds captured through the microphone transmit the 'domain beyond the sounds'? This is explored during the recording and during the composition, by investigating and listening in each recorded location. Then, during the composition process in the studio, the sounds are carefully listened to again, and compared to define families of sound (e.g. timbre, density).

3.3.2.2. Process through Walking and Serendipity

Many writers and artists have already proposed the walk as an art form. For instance, Thoreau mentioned:

> New thoughts, it is not because walking opens up the possibility of thinking but because walking is thinking: 'I am alarmed when it happens that I have walked a mile into the woods bodily, without getting there in spirit (…) The thought of some work will run in my head and I am not where my body is – *I am out of my senses.* In my walks I would fain return to my senses. (Thoreau 2000: 632)

The walk includes the idea of serendipity emerging from spontaneous thoughts and fortuitous occurrences. Discovering, causality, accidents, improvements, and knowledge combine towards describing serendipity, a term coined by Horace Walpole in 1754 (Van Andel 1994: 633). The origin seems to be found in a Persian fairy tale in which an ancient king sent his sons to discover and experience the world (the three princes of Serendip) (Merton and Barber 2004). In following their quest, they had experiences not those originally planned yet accidental and coincidental - and which took them to new horizons. Real or not, the story behind 'serendipity' illuminates a field of possibility for the soundwalker.

3.3.3. Composition

The Extra Personal Space from the title of the piece refers to a combination of different perspectives (presented above) intended to project the auditor into a fictional journey (and space) as both observer and participant. The cinematic approach of the compositional process observes the following key points:

- Movements between micro- and macro-levels of sound and soundscape (e.g. perspectives in recording, travelling as the movement of the camera/microphone) leading to perspectives of the recordings presented below;
- The technique of the recording and montage of *musique concrète.*

The constant movement between micro- and macro-perspectives in the composition leads to an abstraction of the sound, and is comparable to the notion of the abstraction of the sound object from its original 'milieu' (i.e. reduced listening). Here, it is also applied to entire soundscapes.[45] The approach observes spaces *from which* they have been recorded, echoing Truax's perspectives issues on Luc Ferrari's *Presque Rien* series:

[45] The sound object emanates from the technology of the shellac discs and the closed loop. With today's technology, the closed loops may be very long. 'Nonetheless, the idea is not technology led, but based on the music' (Landy 1999: 64). In other words, even with the evolutions in technology, the focus must stay on music, not on any device.

(1) Fixed spatial perspective emphasising the flow of time, or a discrete series of fixed perspectives;

(2) Moving spatial perspective or journey emphasising a smoothly connected space/time flow;

(3) Variable spatial perspective emphasising a discontinuous space / time flow (Truax 2002: 8).

It implies not only the perspectives *towards which* the microphone is pointed, but also includes the acoustic properties of the place of recording *where* the observer/listener stands.

3.3.3.1. Collection of the Sounds in Paris and Etretat / Normandy (Selection of Recording Locations) and Classification

The sounds and soundscapes were discovered during long soundwalks while deep listening both in the city of Paris and on the coast of Normandy. Self-referencing elements such as the sound of footsteps intend to project the listener into the soundscapes of the composition and stimulate the notion of a movie for the ears.

Paris

a) F. Mittérand Library (Google)

b) Pont du Carrousel (Google)

c) Pont Alexandre III (Google)

d) Courtyard, Cité Internationale des Arts (Google)

e) Metro Station Les Invalides (Greenski)

f) Palais de Tokyo, 2010 (Spitzer)

Fig. 3.3.2 Locations and Spaces from Paris

The locations are open in a) and b); semi-open (and reverberant) in c), d) e) and f).

a) François Mittérand, French National Library: The recorded sound is mainly of the wind emanating from the aeration grids, positioned on the ground, of the metro;

b) Pont du Carrousel: The recorded sounds are of a metallic platform on the river and that triggered by its own movements, induced by the waves;

c) Pont Alexandre III: The recorded sounds are of the boat traffic on the river and the related reverberation under the bridge;

d) Courtyard at Cité Internationale des Arts: The recorded sounds are of people throwing bottles into the recycling bin, the ravens and the seagulls, the motion of the metallic gate, and the related reverberation emanating from the courtyard;

e) Metro Station Les Invalides: The recorded sounds are of the train reaching the station, of brakes, and of people talking;

f) Palais de Tokyo: The recorded sound is the reverberation of the pneumatic system from Serge Spitzer's art piece in the Palais de Tokyo museum.

Etretat / Normandy Coast

a) Shingle Beach

b) Seaside from Above

c) Natural Water Containers

d) Natural Water Containers

e) Tunnel

f) Cavity and the Sea

g) Old Bunker

Fig. 3.3.3 Locations and Spaces around Etretat

The locations are open for a), b), c) and d); semi-open (and reverberant for) e), f) and g).

a) Shingle beach: The recorded sounds are pebbles thrown, footsteps and waves on the shingle;
b) Seaside from above: The recorded sounds are of the sound of the waves from above and seagulls;
c) and d) Sea-water containers: The recorded sounds are of the water pouring out of the containers with the waves from the sea in the background;
e) Tunnel: The recorded sound is of the constant flow of wind emanating from the tunnel;
f) Cave by the sea: The recorded sounds are of the waves reverberating in the grotto;
g) Old bunker: The recorded sounds are the reverberation of the sea and people walking on the shingle.

The composition of *My Extra Personal Space* starts by the classification of the material into 'families of sound'.[46] The articulation between the urban and natural soundscapes happens through contrasts among them, and through assimilations created between recognisable sounds as opposed to non-recognisable ones, real *vs*. virtual, mimesis as 'aspects of human culture not usually associated directly with musical material' (Emmerson 1986: 17) and aural discourse 'free of any directly evoked image' (*Ibid*: 19). *My Extra Personal Space* is a 'combination of aural and mimetic discourse with an abstracted syntax' (*Ibid*: 33).

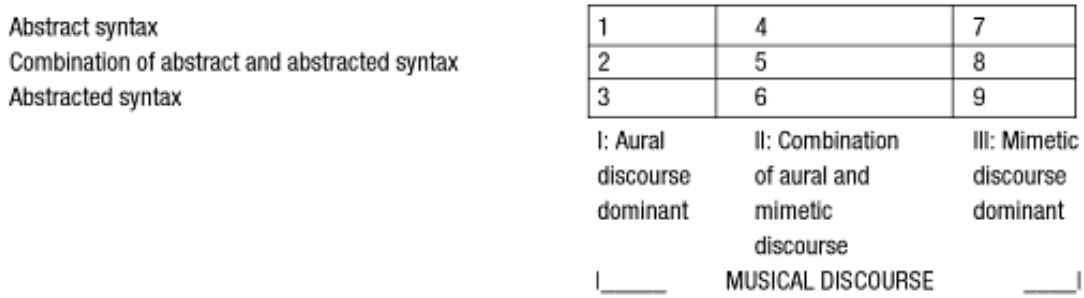

Fig. 3.3.4 The Relation of Language to Material (Emmerson 1986: 24)

[46] Categorisation of sounds.

The classification and layering of the groups of the material is proposed here within the three following categories:

a) Sound Convergences (Recombination of Sounds[47])

Group 1
- Birds at Bibliothèque Nationale François Mittérand;
- Sounds by the Sea.

Group 2
- Wind in the Tunnel by The Sea;
- Sounds by the Sea;
- Distant Sea.

Group 3
- Metropolitan Wind;
- Wind Tunnel by the Sea.

Group 4
- Bells at Cité International des Arts;
- Bunker by the Sea.

Group 4
- Throwing Bottles in the Courtyard at Cité International des Arts;
- Water Pouring from Natural Fountains by the Sea.

Group 5
- Birds in the Courtyard at Cité International des Arts;
- People and Events in the Courtyard at Cité International des Arts;
- Natural Water Canal by the Sea.

Group 6
- Courtyard Noise at Cité International des Arts;
- Distant Sea;
- Birds by the Sea (as a Contrast to the Birds in the Courtyard).

Group 7
- Pneumatic Machines Artwork at Palais de Tokyo;
- Distant Sea.

b) Articulations between soundscapes
- Train Noises and Voices;

[47] 'Recombination' in the genetic sense, meaning that sounds are layered together and are consequently intimately changed (i.e. timbre and energy).

- Morning Voices;
- Thrown Stones by the Sea (as an Articulation Between Movements).

c) Manipulated Sounds for Transitions (with Evolution GRM Tools)

- Bluesman (Busker) in the Metro;
- Eight-piece Orchestra in the Metro.

The above lists of locations and sounds constitute a typology of sounds. The typology is then classified into groups 'working' (in terms of timbre) together, thus a *typo-morphology* as proposed by Landy:

> The definition of sound objects in their inner context, the description of them as structures made up of constituent objects, comes from morphology. Projecting the typological onto the morphological criteria, Schaeffer proposes the term *typo-morphology*, which is where the identification, classification and description of sounds theoretically take place (…) 'Characterology's purpose is the formulation of "genres". These are sound families where sound objects' morphological criteria interact in specific ways' (Dack 1999: 57). Chion writes: 'synthesis of musical objects (…) would aim at producing series of objects of the same genre capable of producing a variation of a relevant feature, or value'. As Schaeffer's means of classification is highly timbre-based, his use of genre here can also be associated with timbre. (Landy 2007: 84)

The classification of *My Extra Personal Space* acknowledges the idea of sound families as 'producing series of objects of the same genre capable of producing a variation of a relevant feature'. The classification is defined by convergences of sonic qualities, intrinsic qualities and the aesthetics of sounds. Families of sound describe the idea of a classification as proposed first by Russolo and later by Schaeffer. In this context, Solomos mentions that 'Maurice Lemaître accuses Schaeffer of having been dishonest with Russolo. He quotes him only one time, (an almost accidental scratch) with the tip of the pen. (…) It cannot be due to a lack of culture, with Schaeffer surely knowing that manifesto (*The art of noise)* (…) It is therefore interference pure and simple from Schaeffer, an attempt characterized as historical murder' [48] (Solomos 2011). This suggests

[48] 'Maurice Lemaître accuse Schaeffer d'avoir été malhonnête avec Russolo. Il ne le cite qu'une fois, et du bout de la plume. (…) Il ne peut s'agir ici d'un manque de culture, Schaeffer

that the music developed by Schaeffer and the classification may find their origins in ideas already discovered by Russolo.

Battier proposes classification insights from Russolo and Schaeffer as emerging from the development of the cities and leading to a new musical vocabulary developed by artists and musicians:

> The meteoric development of cities and industrialization struck artists' and musicians' imaginations (…) With this, sounds from the world became present in and part of composition: the sounds of machinery which led Luigi Russolo to his famous classification (…) typology, allows the classification of sounds by types of objects. It leans on a specialized vocabulary applied to the objects: continua, sustained and discontinuous characteristics, provision of fixed or variable mass, etc. The phase of typological examination produces a classification of the objects. The second level, morphology, is the conceptual tool that categorises the ways of describing the classification of the objects. (Battier 2007: 190, 198)

In the present section, the typology of the sound objects was provided also by the link to the location, by observing how it would influence the nature of the recorded sounds (e.g. open or semi-open, and urban *vs*. natural soundscape). The typological classification leads to families of sounds, and what Battier proposes in the citation above is morphology: how the sounds can work together in the present composition, proposed here as sound convergences (recombination of sounds).

3.3.3.2. GRM Tools

During the period of the composition of *My Extra Personal Space* at the GRM/INA studio at Radio France in Paris, an eight-piece classical orchestra and a bluesman were recorded in the Paris metro, with the intention to use them as transitional material in between movements of the composition; however, the difference of timbres between the soundscapes and the instruments was too abrupt. The GRM proposed trying the imminent version

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connaissant sûrement ce manifeste (…) On se trouve donc devant un *brouillage* pur et simple de la part de Schaeffer, une tentative caractérisée de meurtre historique.'

(May 2010) of *Evolution*[49] from the GRM tools collection which, when applied to the instrumental recordings, provided appropriate timbres. Battier summarises the development of the GRM tools as follows:

> The filters allow sounds to pass through adjustable frequency bands up to a level where the filter itself resonates and accompanies the treated sound with a sort of spectral reverberation. Besides that, the musician can freely choose the number of filters making up the treatment set, as it is software-based and the only limits are those of the machine: the gesture now takes place in the virtual domain. (Battier 2007: 200)

GRM tools, and in particular the *Evolution* plug-in, proved to be most helpful in the current context. Treatment with them allowed the development of unique timbres from the soundscapes. Conceptually proposed, it is a work on the reverberation and spectral elements of a material recorded in the metro where reverberation is already present. It pushes further the idea of composing vertically by superimposing layers of reverberation (that of the metro together with the spectral reverberation from the GRM tools) and, as a result, a shifting between the real space and the virtual created by the layering.

3.3.3.3. Compositional Process

My Extra Personal Space is intended to create a movie for the ears, not only as a conceptual idea, but also through the compositional process. The development of the piece is included in the fictional narration of a journey into urban and natural, rural soundscapes. The experience of the author evolved through psychogeographical soundwalks and was supplemented by perspectives of locations, as proposed in Section 3.3.3.

The length of the piece is 16'16'' and it is divided into six sections. Each section is a movement with real sounds. Transitions are provided by synthesis sounds as articulations between the different movements. Fontana's remark in Section 3.3.1 claims that 'most people approach this experience without recognising patterns in everyday sound.' Therefore, the following composition's structure

[49] Spectral and harmonic audio transformations.

highlights the patterns of the composition. These are intended to bring the auditor into a known environment of the composition by proposing the themes several times. Transitional patterns, sustain, tension and release of tension are also mentioned:

1. **Introduction / 0' to 1'00''**
   Helicopter Mutates into Birds (*Aerial perspective*).

2. **Transition 1 / 30' to 1'55''.**

3. **Movement 1**
   1'25'' to 3'50'' Rasping Object on the River (*Pattern*) / Town activity / Birds by the Sea (*Pattern*);
   1'43'' to 3'13'' Bell with Fade Out with Pitch Down.

4. **Transition 2 / 2'57'' to 4'50''.**

5. **Movement 2**
   3'50'' to 4'08'' Birds Group (*Pattern*);
   4'05'' to 5'07'' Wind into Tunnel (*Sustain*);
   4'30'' to 6'17'' Sea (*Pattern*);
   4'53'' to 6'15'' Pebbles (*Pattern*);

6. **Transition 5'10'' to 6'00''**

7. **Movement 3**
   5'13'' to 6'10" Footsteps (*Transitional Pattern*);
   5'50'' to 6'08'' Voices speaking;
   6'18'' to 7'30'' Pouring Water;
   6'25'' to 8'10'' Thrown Bottles;
   6'30'' to 7'30'' Sea (*Pattern*);
   6'43'' to 6'56'' Group of Birds.
8. **Transition 7'30'' to 10'30''**

9. **Movement 4**
   7'35'' to 8'38'' Footsteps (*Transitional Pattern*);
   7'45'' to 8'03'' Birds aerial (*Pattern*);
   7'45'' to 8'25'' Helicopter (*Pattern*);
   8'40'' to 8'50'' Seagull;
   9'12'' to 11'30'' Machines;
   9'30'' to 9'40'' Pebbles (*Pattern*);
   9'58'' Train;
   10'08'' to 10'23'' Helicopter (*Pattern*);
   10'12'' Dog;
   10'30'' to 13'00'' Water.

Release Tension 11’11’’

10. Transition 11’45’’ to 12’55’’

11. Movement 5

11’47’’ to 12’05’’ Rasping Object on the River (*Pattern*);
12’08’’ to 13’30’’ Birds.

Release Tension 13’00’’

Lots of Birds / Increase Tension 13’10’’ to 14’20”

Release Tension

14’10’’ to 15’50’’ Birds in Enclosed Space;
14’23’’ to 14’35’’ Footsteps on Pebbles Leading to Outside Space;
15’04’’ Opening Door Leading to Outside Space;
15’36’’ Outside Space Footsteps. Walk on a Path Until End. Fade Out.

12. End 16’16’’

The first audience answers are presented as a summary from the questionnaire related to the intention / perception investigation, and is developed further in Chapter Five. The following patterns of perceived spaces / locations are observed in relation to the composition appreciation of thirty participants who listened to the piece only once:

- Seaside or beach (also occasionally associated with seagulls) appears in eighteen answers. This is the strongest pattern;
- Bells (also occasionally associated with church) appear in ten answers;
- Factory (also occasionally associated with dockworkers or port activity) appears in nine answers;
- Walking person (also occasionally associated with footsteps) appears in seven answers.

The first aspect underlines the audience’s sensibility to patterns when sounds / soundscapes are presented several times in the composition. On the other hand, the sound of bells appears only once briefly at the beginning, yet is the second most mentioned sound.

Patterns of sound (meaning those played several times in the composition) have a role in the perception of a sound-based piece, and because the audience seems to recognise them they allow the reduction of semantic ambiguity that may arise in sound-based compositions. Pattern recognition is of course nothing new in music composition nor, to a greater extent, in organised sounds. The analysis of the perception of the portfolio as based on the questionnaire in Chapter four helps to identify the sound pattern recognition perceived by numerous participants.

On the other hand, signals such as bells are clearly mentioned by the audience. These do not require patterns for familiarity. It may be questioned whether this is linked to the early presence of the sound of bells in the composition, when the attention is greater.

3.3.4. Achievements; Conclusions

The major achievement from *My Extra Personal Space* relates to the creation of a coherent piece based on contrasting urban and natural environments. In order to achieve the composition, a clear methodology was established, which includes the following procedures:

- The observation of the location is based on a cinematographic approach through long static shots / recordings, allowing the development of events. This relates in particular to Truax's insights on perspectives and to Luc Ferrari's *Presque Rien* series. The process of composition is also stimulated by a cinematographic approach, in the sense that there is a wish to stimulate and develop images in the mind of the audience;
- Psychogeography is included with the effects of the geography of the urban *and* the natural environments on the mind of the composer. This is the kind of memory the geography imprints in the mind of the composer during field recordings and later transferred to the audience. This serves as the first draft of the composition while listening;
- The recordings developed a broader lo-fi *vs*. hi-fi discourse by revealing combinations in the classification of sounds. In addition, the classification

of sonic material for composition purposes leads to the insights proposed by Pierre Schaeffer and Luigi Russolo, yet are applied here to the whole soundscape;

- Emmerson's grid helped to define a balance between real and unreal sounds. Therefore, a coherent form of composition was composed in order to retain the auditors' attention.

Future research should investigate deeper the perception of soundscape and sound objects in electroacoustic contexts in order not only to provide novel knowledge for compositional issues, but also to bring wider knowledge into the realm of the perception of electroacoustic music. Although the current research focuses on pattern perception, Landy pointed out that:

> Interdisciplinary work with specialists in areas such as perception could be very useful, not only in terms of providing relevant information for composers, but also in terms of furthering our knowledge of how electroacoustic music is experienced. (Landy 2007: 81)

Finally, the unique opportunity to research at the Groupe de Recherches Musicales in Paris, and investigate its history, the technology and the important knowledge provided by the main actors working there or related to its history (in particular Daniel Teruggi, Evelyne Gayou, Brunhild Ferrari and Diego Losa) allowed the development of *My Extra Personal Space* within an incomparable inspirational situation.

Kinetism
Sound installation

Fig. 3.4.1 *Kinetism*, Archizoom Gallery, Lausanne, Switzerland, 2009 (Forcucci)

By changing space, by leaving the space of one's usual sensibilities, one enters into communication with a space that is psychically innovating…
For we do not change place, we change our Nature – Gaston Bachelard

Summary

The sound installation *Kinetism* invites the audience to take a stroll around an environment where each might realise an internal *vs*. external sound dialectic: one's own body's sound (internal auditory space), which is mostly unconscious as part of the vital functions both of the organism and of urban soundscapes (external auditory space). These internal and external perceptions open a channel to zones of the indiscernible defined by the convergence of inner and outer sounds in the exhibition space; the indiscernible relates to Deleuze's and Guattari's remarks about reducing oneself to an abstract line:

> Imperceptibility, indiscernibility, and impersonality – the three virtues. To reduce oneself to an abstract line, a trait, in order to find one's zone of indiscernibility with other traits, and in this way enter the haecceity and impersonality of the creator. One is then like grass: one has made the whole world into a becoming because one has suppressed in oneself everything that prevents us from slipping between things. (Deleuze and Guattari in Hallward 2006: 4)

The convergence of the internal and external sounds is intended to create a temporary zone (an abstract line) experienced by the participant while walking into the installation. The perception of the convergence is the space defined by *Kinetism,* which fits into the virtual space categories of the map of research. The inspiration for this piece comes from 'out-of-body experiences', studies observed while engaged in an artistic residency at the Laboratory of Cognitive Neuroscience of the Brain Mind Institute in Switzerland from March to November 2009.

3.4.1. Introduction

Kinetism is part of the virtual space defined by the map of the research. The piece investigates the possibility of virtual space involving neither computers nor networks; instead, the virtual space relates to a subjective experience,

perceived through careful listening in a darkened room. Listening is the central focus. It points to the affirmation from the French philosopher Roland Barthes, who pointed out a difference between the notions of *hearing*, which is a physiological faculty, and *listening*, which is a psychological act (Barthes 1985: 245). Barthes is echoed by Schaeffer, who proposes four modes of listening, in French *les 4 écoutes:*

(1) *Écouter* is listening to someone, to something; and through the intermediary of sound - aiming to identify the source, the event, the cause - it treats the sound as a sign of this source, this event (Concrete/Objective).

(2) *Ouïr*, to perceive with the ear, to be struck by sounds, is the crudest level, the most elementary of perception. We thus 'hear', passively, many sound sources that we are trying neither to listen to nor to understand (Concrete/Subjective).

(3) *Entendre*, here, according to its etymology, means to show an intention to listen [écouter], selecting what particularly interests us from what we hear [ouïr], thus 'determining' what we hear (Abstract/Subjective).

(4) *Comprendre* means grasping a meaning or assigning values, by treating the sound as if it were a sign, referring to this meaning as a function of a language, a code (semantic hearing; Abstract/Objective) (EARS n.d.).

Those ideas, in relation to *Kinetism,* suggest four different modes of perceiving sound in relation to the dedication and listening. Therefore, the perception of the sound in relation to the installation is more or less developed. Kane emphasises the ideas of modes of listening from Schaeffer presented above, by highlighting the acousmatic experience of sound towards the content of the auditory perception:

> *The acousmatic experience reduces sounds to the field of hearing alone.* This reduction is really a matter of emphasis; by shifting attention away from the physical object that causes my auditory perception, back towards the content of this perception, the goal is to become aware of precisely what it is in my perception that is given with certainty, or 'adequately' (Husserl 1901: 206-8 in Kane 2007: 3).
>
> This reduction is intended to direct attention back to hearing itself: 'Often surprised, often uncertain, we discover that much of what we thought we were hearing, was in reality only seen, and explained, by

the context.' (Schaeffer 1966: 93 in Kane 2007: 3).

Kinetism is a journey into the internal and external space of the self at the same time. Most importantly, it is a virtual subjective space that exists at the same time and place. The body sounds and the urban soundscapes blend and are felt during the participant's walk. *Kinetism* explores new territories of the mind through a deep listening experience of the environment, which includes the sound of the self.

3.4.1.1. Mapping Virtual Space

Virtual spaces or worlds refer to an environment of computers and networks. According to Bell the following definition encompasses the virtual space: 'A synchronous, persistent network of people, represented as avatars, facilitated by networked computers' (Bell 2008: 2). The definition includes the use of computers and/or a network to achieve a synthetic virtual world.
However, the present work proposes another type of virtual space. According to Dixon, visionary French theatre theorist Antonin Artaud was perhaps the first person to coin the term 'virtual', describing in *The Theatre and Its Double* (1938) how 'theatre's virtual reality develops (…) [on the] dreamlike level on which alchemist signs are evolved' (Dixon 2006: 24). Artaud establishes a relationship between the action of the theatre and the subjective perception of the spectator. The definition of virtuality that is linked to *Kinetism* is proposed in the relation of alchemy with theatre, and as such includes alchemical symbols linking to that virtuality proposed by Artaud:

> There is a still deeper resemblance between the theater and alchemy, one which leads much further metaphysically. It is that alchemy and the theater are so to speak virtual arts, and do not carry their end - or their reality - within themselves. (…) All true alchemists know that the alchemical symbol is a mirage as the theater is a mirage. And this perpetual allusion to the materials and the principle of the theater found in almost all alchemical books should be understood as the expression of an identity (of which alchemists are extremely aware) existing between the world in which the characters, objects, images, and in a general way all that constitutes the virtual reality of the theater develops, and the purely fictitious and illusory world in which

the symbols of alchemy are evolved. (Artaud 1958: 48, 49)

In that sense, sound does not carry its reality with itself either. Sound could be compared to a kind of symbol triggering virtual reality in the mind of the auditor. The mind transforms those symbols into mental imagery, which is the subjective perception of the audience.

Kinetism relies on a fictional space of one's own body blended with urban soundscapes. The fictional space is a diegesis constructed by movement into the installation and subjectivity. The spaces included in *Kinetism* are the following:

- The space of the installation at the gallery;
- The virtual space perceived by the participant: the convergence of internal (body sounds) and external (urban soundscapes) spaces;
- The perceived internal space;
- The perceived external space.

3.4.1.2. Perception Issues and the Body as Mediator

Kinetism invigorates the experience of the participants to foster self-identification through body sounds, and explores the relation between mind and matter, as expressed by Leman:

> The relation between mind and matter is one of the main themes of the history and philosophy of music research. In this overview, attention has been drawn to the fact that three components of ancient Greek thinking provided a basis for this discussion: acoustic, perception, and expression ('movement of the soul') (…) Cognitive science, influenced by gestalt theory, had a main focus on mental processing, whereas new approaches stress the role of the human body as mediator between matter and subjective experience. (Leman 2002: 49)

The sounds of the body emphasise the relation between mind and body, where matter is the perception of one's personal space as an experience according to Leman:

> Scientific methodology has been expanding from purely physical issues (music and sound) to more subjective issues (music as experience). The connection between the two draws on fundamental relationships between mind, body and matter. (*Ibid*: 49)

The virtual space investigated through *Kinetism* develops upon the idea of an experience of the work by the audience. By walking into the installation, the audience is invited to explore the virtuality of the work, which relates to one's own mind, body, and matter.

3.4.1.3. Sounds of the Body

Body sounds (heartbeat and breath) trigger self-identification. Accordingly, Armstrong mentions links between the current states and activities of our environment and our body:

> Introspective consciousness (…) is a perception-like awareness of current states and activities in our mind. The current activities will include sense perception: which latter is the awareness of current states and activities of our environment and our body. (Lycan 1995: 1)

The body is closely linked with the history of sonic arts, and is firstly contextualised here with sound emerging from the body, a raw and direct sonic expression of the body. The Dadaists and the Futurists used guttural and other sounds produced by the body (e.g. coughs and sneezes by Kurt Schwitters) in sound poetry at the beginning of the twentieth century. Sound poetry 'operates through a denial of signification toward an ideal of the unification of expression and indication (…) an emotive, intonational language is seen as being more true for human condition than signifying language because its expression is that of the body (…) it is a sounding of one's human space' (Erickson 1985-1986: 280). Secondly, there is a long history of works exploring the interaction between the work of art and the body of the participant and which promote the notion of experience. Marcel Duchamp explored this idea with the *Rotoreliefs* discs, covered with drawings or words. The illusion of three-dimensionality unleashed by the rotation of his discs was something achieved 'not with a complicated

machine and a complex technology, but in the eyes of the spectator, by a psycho-physiological process' (Richter 1965: 99).

Duchamp called for a non-retinal art, a suprasensorial experience. Therefore, the artwork emanates from the discs as an experience.

Kinetism proposes an experience: the participants discover the 'inside – outside' sensation while walking into the sound installation as the illusion of three–dimensionality emerges in Duchamp's work while the discs rotate.

Fig. 3.4.2 Rotorelief n°12 - Spirale blanche, 1935 (Duchamp)

Maryanne Amacher's *CD Sound Characters (Making the Third Ear)* (Amacher 1999) follows the same idea of Duchamp's psycho-physiological process. The work is the result of a *sonic experience* and not the sound *itself*. In the *CD Sound Characters (Making the Third Ear)* 'the listener actually has vivid experiences of contributing to [the] sonic dimension' (Amacher in Oteri in Ouzounian 2006: 73).

> The tones in this music will cause your ears to act as neurophonic instruments that will seem to be issuing directly from your head, meeting and converging with the tones in the room (...) Tones dance in the immediate space of their body, around them like a sonic wrap, cascade inside ears, and out to space in front of their eyes, mixing and converging with the sound in the room. (*Ibid:* 74)

Kinetism is concerned mainly with Amacher's definition:

> Where sound, body and space meet, new dimensions of, and sensitivities towards, environments can be engaged, and our relationship to these and to ourselves and each other within these can be re-imagined and transformed. (*Ibid:* 78)

The following selection of body sounds in performance and fine arts is of interest for the research:

- **Christopher Janney / Heartbeat (1983)**
  Mikhail Baryshnikov danced to the accompaniment of sounds generated by his own body through a device.[50] (MIT Museum 2011)

This very simple installation - aesthetically, not technically - shows how powerful those sounds are for self-identification in a work of art. In Janney's work there is an even greater phenomenology of biofeedback as the rhythm of the music is the rhythm of the dancer's own heart. It relates to the idea of corporeal intentionality as proposed by Leman at Section 3.4.1.4 through the exploration of inner and outer environing.

- **Cod_Act / Siliknost2 (2004)**
  Two individuals shift a massive rock by traction, using cables and pulleys. They are kitted out with sensory captors that measure their physiological activity in real time. Sounds and micro-sounds produced by their physical effort are captured, amplified and re-transmitted in the premises. (Cod_act 2004)

This project relates to *Kinetism* through the idea of the amplification of the body sound into the performance or exhibition space, and how such an unusual situation may affect the audience. For *Kinetism*, such amplification might provoke a shift between the internal normal perception of the personal space and its position outside the body due to the amplification of the bodily sounds.

[50] A wireless microphone.

- **Christian Boltanski / The Heart Archive (2010)**
  This is a monumental work that collects the sounds of as many different human heartbeats from around the world [as possible] (…) Ultimately, the collection will comprise a heartbeat library in a purpose-built museum on an uninhabited island called Teshima, in Japan. (…) The work is really a reflection on death and memory, and ironically questions our obsession with immortality. (The Telegraph 2010)

The conservation of biological recordings is a conceptual idea that relates to *Kinetism* in order to allow the audience to experience internal sounds. It questions the idea of memory of the self, and empathy, since some participants have mentioned adapting their rhythm to the sound of breath or the heartbeat.

Kinetism proposes an experience similar to those of Duchamp and Amacher. A greater or smaller impression of external *vs*. internal space is experienced according to the position of the listener within the installation. The piece allows the experience of biofeedback as in Janney and Cod_Act.

3.4.1.4. Extension of the Body Space Perception through Sound

Body and environmental sounds are never experienced at the same time, place and volume. This suggests a possibility for *Kinetism* to intend to create a space going beyond the three-dimensional perception of space where it becomes 'a moment of becoming', where the body is 'contaminated'[51] and a 'contaminant', leading to 'a passage from one space to another'. According to Carter and O'Shea:

> In refusing to conceptualise space as a three-dimensional container, a passive receptacle or void, whose form is given by its content, we come to know space as 'a moment of becoming, of opening up and proliferation, a passage from one space to another, a space of change, which changes with time' (…) the contemporary body is both 'contaminated' and a 'contaminant', erupting and displacing borders between soma and city, the organic body and the built environment,

[51] By the space.

> corporeality and virtuality, container and contents, inside and outside. (Carter and O'Shea 2010: 61)

The participant explores the zones of convergence that emerge while he/she walks into the installation and senses the 'inner' and the 'outer spaces'. This is where the composition exists and how the participant perceives it, always different for each person. Accordingly, Leman proposes:

> The knowledge of the outer, environing world is determined by receptors and effectors that define what becomes a stimulus or sign for a biological organism. The inner environing world is created by the directing apparatus of the biological organism that is the movements and actions in the environment. Corporeal intentionality can be understood in terms of a coupling of these two spaces. (Leman 2002: 85)

Corporeal intentionality[52] is reached in *Kinetism* through the coupling of internal and external spaces, while walking inside bodily sounds and the environmental sounds of the sound installation.

3.4.2. Context of the Work Itself

The project developed during a residency at the Brain Mind Institute of the EPFL (Swiss Institute of Technology, Switzerland) in 2009. I spent nine months in the Laboratory of Cognitive Neuroscience with Professor MD. Ph.D. Olaf Blanke, who is a neuroscientist and neurosurgeon. His research investigated scientific approach of out-of-body experiences, described as follows:

> Autoscopic phenomena (AP) are rare illusory visual experiences during which the subject has the impression of seeing a second own body in extra personal space. AP consists of out-of-body experience (OBE), autoscopic hallucination (AH), and heautoscopy (HAS). (Blanke and Mohr 2005)

During our discussions, the research interest was into the sense of agency related to proprioceptive sounds, here explained by Knoblich:

[52] 'Corporeal intentionality can be conceived as an emerging effect of action/perception couplings, the underlying engine of which can be defined in terms of the sensorimotor system' (Leman 2002: 84).

> Consider the following prototypical scene that may occur in any number of crime movies: An unsuspecting man walks along a dark, lonely street. The shabby houses along the street reflect a loud echo of what appear to be his footsteps. Behind him is a dark figure walking at the same pace, closing up on him. The viewer hopes that the poor victim will notice that there is another, malicious, person in the scene. And indeed, at some point the victim turns around, suspecting he is not alone. But it's too late. The screen turns dark. The example illustrates that, although it is crucial to determine whether one is causing the perceptual events one perceives, it is not always easy. This is the problem of agency. How do I know whether I am causing the rhythmic sounds of footsteps? When do I begin to suspect that another actor is causing some of these sounds? Do cognitive expectations, such as my belief that I am walking alone, affect agency? (Knoblich and Repp 2009: 248)

In addition Neisser relates to 'Gibson (1979) who was the first theorist to insist that perceiving the self is an inevitable counterpart of perceiving the environment' (Neisser 1993: 3). With the above proposals a direct link exists between the perception of outer and external spaces. As an accomplishment of our discussions with Professor Blanke, 'we attempted to achieve an "out-of-body experience" through sound' in a sound installation, where the audience is invited to explore sounds of the body included into environmental sounds. The stroll into those sounds might provide such experience by amplifying the internal bodily sounds into the exhibition space.

3.4.2.1. Internal and External Space Relations

Fig. 3.4.3 Moebius Strip (Holdsworth 2009)

The relation between the internal and the external perceptions of space in *Kinetism* connects, too, to ideas mentioned by Deleuze and Guattari about the creation of interiorities and exteriorities being not two separate paradigms, but one continuous plane:

> An outside more distant than any external world, because it is an inside deeper than any internal world: it is immanence.
> (Deleuze and Guattari in Massumi 2002: 102)

In *Kinetism*, the relation (internal *vs*. external) relates to a unique experience of the participant creating his/her own virtual world. The idea is proposed and defined by Antonin Artaud and refers to subjectivity (see Section 3.4.1.1). Hence, subjectivity has multiple strata 'whereby a fragmentary whole emerges, a *unitas multiplex*, a unity in multiplicity and absolute survey that involves no supplementary dimension' (Ruyer in Massumi 2002: 103).

3.4.2.2. A Neuroscientist's View of Space Perception

When *Kinetism* was presented (along with works from Max Neuhaus, Christian Marclay and Carsten Nicolai, among others) in October 2009 at the gallery Archizoom in Lausanne (Switzerland), Professor Olaf Blanke wrote the following words to introduce the neuroscientific view of the perception of space:

> Perceived and imagined **spaces** are constructed via our sensory systems such as sound, vision, touch as well as the motor system in the human brain. Within the perceptual domain, space may be subdivided into different spatial compartments, such as the personal space (one's own body) and the extra personal space, which comprises the near space (within reaching distance) and the far space (beyond reaching distance) (Grüsser 1983). How are these personal and extra-personal spatial compartments represented in the human brain? This has been, most strikingly, investigated in neurological patients suffering from a condition called unilateral spatial neglect. These patients fail to attend to or to explore the space contra-lateral to their brain damage that is most often found in right parietal cortex.
>
> **Unilateral spatial neglect** exists in response to sensory stimuli (perceptual neglect) and it has been demonstrated that perceptual neglect can selectively affected personal or extra personal space

(Bisiach *et al*. 1986; Guariglia & Antonucci 1992; Beschin & Robertson 1997). A patient with personal perceptual neglect will thus not attend to stimuli actually on his/her body (personal space), but to those close to or distant from his/her body.
Unilateral neglect also exists when imaging spatial scenes such as imagining familiar spatial scenes (representational neglect) and may be present when thinking about familiar city squares, familiar room interiors, or country maps (Bisiach & Luzzatti 1978).
Representational neglect also affects personal or extra-personal space selectively (Ortigue *et al*. 2006). A patient with extra-personal representational neglect will thus normally perceive personal and extra-personal space, but show deficits when imagining space, for example, familiar city squares.
Most researchers investigated perceived and imagined visual space. How is **auditory space** represented in the brain? Auditory space is encoded in the auditory neural system that projects from the ear to the auditory cortex (Griffiths *et al*. 2004) and is conveyed further to the right parietal cortex (Bellmann *et al*. 2001). We currently do not know much about the dichotomy between personal and extra personal space in the auditory domain. Moreover, our personal auditory space seems more complex than its visual counterpart and consists of an external auditory space (skin contact, footsteps) and an internal auditory space (heartbeat, stomach contractions).
Here, an artist and a neuroscientist invite the spectators to explore for themselves different auditory spaces.

3.4.3. Composition

How could it be possible to perceive an 'out-of-body' experience based on sound and in order to use such perception of reality as inspiration for an artwork? The constant 'in' and 'out' impressions induced by the walk into the sound installation are intended to create an illusion of transitional space lying between the internal and external spaces of one's own body. This transitional experience is the 'out-of-body' experience. Catherine Christer Hennix points toward perceptions of internal and external space through raga:

> As a raga or chant unfolds it opens up an inner space which progressively effects the perception of the *outer space*, one space aligning itself with the other along the intersection between sound and consciousness (…) Especially applicable to a musician in performance or practice, Vedic space becomes an *emergent phenomenon* by which each sound defines a unique state of space perceived in terms of a certain 'quality' or 'ambiance' specific to it as *mediated by a unitary ground state change originating in the*

> *minds of those present* (…) Following this lead, new areas of sound can emerge which, if not facilitating this correspondence, at least can enhance its prominence. (Hennix in Dietz 2011: 59)

Dietz mentions that 'with artists such as Hennix, however, we begin to understand 'the drone' as a starting point – as the first step in understanding listening and composition as the perpetual casting of subjectivity' (Dietz 2011: 59).

3.4.3.1. Site-Specific Composition

Kinetism is the result of the layering of body sounds and soundscapes recorded in several cities[53]. The virtual space is created by movements and trajectories of the author and the participants on site and off site, which are:

- Those while the sound is being collected by the author in town. (On site)
- The stroll taken by the audience into the work. (Off site)

Massey develops further the construction of space with trajectories:

> Space is its trajectories: '(…) as the product of interrelations (…) as the sphere of the possibility of the existence of multiplicity in the sense of contemporaneous plurality; as the sphere in which distinct trajectories coexist (…) as always under construction.' This mobility and provisionality, even in the theorization of space, has made work with the local and site-specific more problematic than before. (Massey in Smith 2010: 113)

Moreover, De Certeau suggests that trajectories define how a place is transformed into a space by its practice:

> *Space is a practiced place.* Thus, the street geometrically defined by urban planning is transformed into a space by walkers. (De Certeau in Kaye 2000: 4)

The virtual subjective space in *Kinetism* is contextualised by the affirmations of Massey and De Certeau. *Kinetism* fits into the site-oriented category. Soundscapes from a site are integrated into the work and are layered together

[53] The city of Lausanne for the first exhibition in 2009. The actual final version includes the cities of São Paulo, Shanghai and Berlin, as developed in Section 3.4.3.3.

with body sounds at the exhibition space. Therefore, the work is off-site, yet it is still *site-oriented.* Kinetism is a form of working that includes the sound of several sites, which are then proposed away from their original locations. In relation to the *site-oriented* definition of *Kinetism* as the representation of a space and thus a virtual subjective space, Crimp argues that '[t]he desire of representation exists only insofar as it can never be fulfilled, insofar as the original always is deferred. It is only in the absence of the original that representation can take place' (Crimp in Kaye 2000: 6). In *Kinetism,* such absence relates to a mental and virtual representation.

3.4.3.2. Listening to the Town

The process of sound selection for the installation starts with the following methodology:

a) Identification with a map of areas with potential sonic identification (e.g. underground trains, church bells);
b) A soundwalk into the town for the 'on-site' perception of the locations.

The methodology reflects issues in Maryanne Amacher, ones that Dietz describes as:

> Her insistence on the articulation of 'modes of listening', 'ways of hearing' is one of the only authentically post-'Drone' conceptions we have. Her generosity in reading Cage's 'special attraction to everyday sounds' as an attraction to 'the availability of multi [-] perceptual viewpoints' only heightens the distance between his singular listening subject and her poetic, even futurist, plural trajectories. (Dietz 2011: 60)

The procedure to organise urban soundscapes echoes perceptual geographies expressed by Amacher. Also, it promotes her definition of the shift from the composer to the performer, then from the performer to the audience:

> We have seen how the emphasis shifted with Cage from the composer to the musicians who perform the score. Here it will shift from the composer to anyone who might have the 'score' in their living room. With recent developments, we may delve into even more intense possibilities: entering the interior of the music in startling new

> ways, perceptually. Composers will soon learn how to develop the 'perceptual geographies' that will become the maps for vivid, personalized experiences in the sonic worlds of these 'home scores'. (Amacher in Dietz 2011: 60)

In *Kinetism*, the responsibility of the composer is transferred to the audience, who are invited to have a walk into the sound installation. Therefore, the audience perceives urban sonic identities as 'perceptual geographies'.

3.4.3.3. Compositional Process

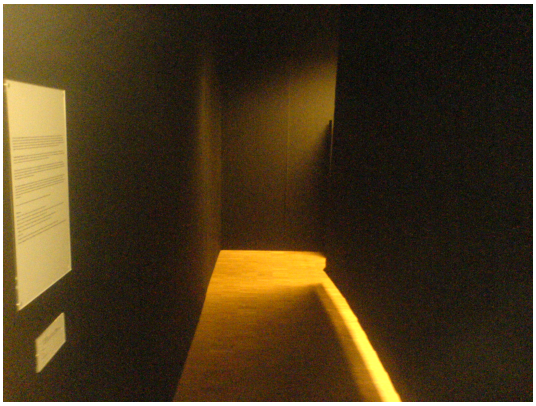

Fig. 3.4.4 Entrance of *Kinetism* (Forcucci)

Fig. 3.4.5 View of *Kinetism* (Forcucci)
As premiered in October 2009 in Lausanne, Switzerland

The set-up of the installation consists of four loudspeakers included into a square and diffusing sounds from the body (internal space). Four other loudspeakers surrounding the first square define another, larger, square with soundscape (environmental external space).

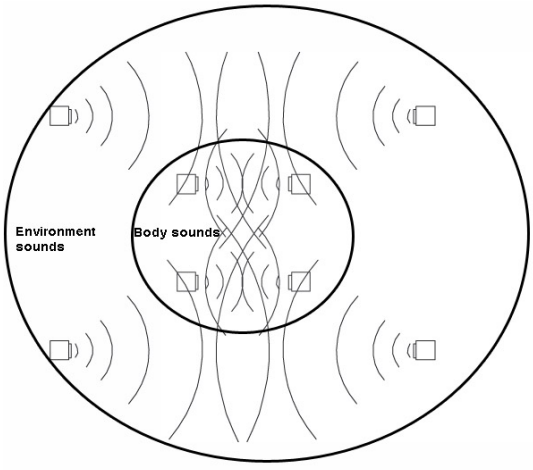

Fig. 3.4.6 Top view of the installation
As premiered in October 2009 in Lausanne, Switzerland

Urban and body sounds are prepared for two different arrays of loudspeakers (Fig. 3.4.5.). These arrays are two quadrophonic sets, which evoke the internal space (internal quadrophonic) and the external space (external quadrophonic). For the current version as part of the attached documentation, an ambisonics[54] panning system is included with an external object for Max/Msp (Schacher and Kocher 2012) and is used for the surround system. Ambisonics panning has been chosen as a simple way of enhancing stereo files and 'spreading' them through an octophonic array of loudspeakers. Neukom presents the system as follows:

> Ambisonics is a surround-system for encoding and rendering a 3D sound field. Sound is encoded and stored in multi-channel sound files and is decoded for playback. (…) The mathematics used in ambisonics theory is beyond the skills of non-scientists or non-engineers. Since panning functions are familiar and easy to visualize they provide a good didactical means for explaining ambisonics to laymen and for deriving encoding formulas and gains for in-phase decoding. (Neukom 2007: 1,7)

In *Kinetism,* the recordings of the urban soundscapes have not been made in b-format with a Soundfield microphone; rather, they are stereo files and are encoded, decoded, and diffused as such. The idea is to intend to create a surrounding environment with stereo field recordings from São Paulo, Shanghai,

[54] 'Ambisonics was the brainchild of a small group of British academics, notably Michael Gerzon of the Mathematical Institute in Oxford, and Professor P.B. Fellgett of the University of Reading. From the beginning, it was designed as a surround sound system that would overcome the major problems of the so-called 'quadraphonic' systems that were its predecessors -- the main one being that they simply didn't work very well. Research rapidly indicated, however, that in addition to providing full surround sound in an encode/decode environment (where the original recording is encoded into a stereo/mono-compatible form for transmission and later decoded by the listener into multiple speaker feeds), Ambisonics could also offer a significant 'super stereo' capability without decoding (…) Ambisonics built on the astonishing work on stereo recording and reproduction performed by Britain's early audio genius, Alan Dower Blumlein (…) Blumlein realised that there was more to the ear/brain combination's ability to position sound source in space than merely the difference in level between the ears. The principle is easily illustrated by considering a conventional mixing console panpot being used to pan a mono signal between two speakers -- an illustration that indicates, too, how little Blumlein's work is now remembered in the audio industry' (Elen and Carlos 1991).

and Berlin[55] through ambisonics. In a way, this is another virtual space since it creates surround information based on front (stereo) recording.
The first internal stereo array includes a mono file diffused on two loudpeakers with sounds of breathing and a heartbeat without ambisonics encoding/decoding. The second external and octophonic array surrounds the first one. It includes one channel with soundscapes from São Paulo, Shanghai, and Berlin; these are not moving, but are diffused on the eight loudspeakers, and a second channel with voices moving around the same eight loudspeakers. The voices are in Portuguese from a market in São Paulo, in Chinese from the streets of Shanghai, and from a Swiss opera singer[56] for the German. The last is a poem by Rainer Maria Rilke, the first poem from a collection called 'I am celebrating'[57]:

This is desire: to live in the balance
and not to have a home within time
And these are wishes: soundless dialogues
during daily hours with eternity
And this is life. Out of a yesterday
rises the loneliest hour
which, smiling unlike its other sisters
remains silent in the face of the eternal.[58] (Rilke 1899)

3.4.3.4. Walking into the Composition

The artwork itself is the experience of the audience while walking. The walk into the sounds and the perception of the convergence of internal and external spaces is the composition. It reflects the ideas of the Brazilian neo-concretists,

[55] Future research will investigate B-Format and related ambisonics for this kind of piece.
[56] Michael Leibundgut.
[57] *Mir zur Feier*.
[58] Das ist die Sehnsucht: wohnen im Gewoge
und keine Heimat haben in der Zeit.
Und das sind Wünsche: leise Dialoge
täglicher Stunden mit der Ewigkeit.
Und das ist Leben. Bis aus einem Gestern
die einsamste von allen Stunden steigt,
die, anders lächelnd als die andern Schwestern,
dem Ewigen entgegenschweigt.

who worked towards creating a participatory experience through action. Gullar describes the participatory experience as a work of art:

> It's a rediscovery of the world: Colors, space, do not belong to this or that artistic language, but to the living and indeterminate experience of man. To deal directly with these elements, outside the institutional frame of art, is to reformulate them as if for the first time (…) the spectator is solicited to *use* the 'non-object'. Mere contemplation is not enough to reveal the sense of the work – the spectator goes from contemplation to action. But what is action produces is the work itself, because that use, foreseen in the structure of the work, is absorbed by it, revealed and incorporated into its signification. (Gullar in Amor 2010: 23)

On the other hand, Lippard and Chandler argued 'that the ideational emphasis of some new art had resulted in the dematerialization of art.' They suggested that 'works of art are like words' and function as 'signs that convey ideas (…) Such a work is a medium rather than an end in itself (…) The medium need not to be the message, and some ultraconceptual art seems to declare that the conventional art media are no longer adequate as media to be messages in themselves' (Stiles and Selz 1996: 806).

3.4.4. Achievement, Conclusions

Another dream: an interior which is the external, a window and I. Through this window I want to go outside and this for me is the window and I want to go outside and this for me is the inside. When I wake up, the window of my room is the one of the dream, and the inside that I was searching for is external space

— *Lygia Clark*, About the Act

Kinetism explores the movements and sounds of our body in urban soundscapes and how, combined together, they can lead to a virtual space. The walk *into* sonic artwork contrasts with a traditional spectator approach. It opens opportunities for the development of works including the stroll, the personal experience through personal, peripersonal, extrapersonal spaces and self-identification as major components.

Kinetism is a contextualised soundwalk within a site-oriented perspective. The stroll, the experienced convergence of the body sounds recorded and the city soundscapes trigger an almost impossible perception in real life: the perception of internal and external personal spaces present at the same place and time, like an out-of-body experience in a plane of immanence. Concurrently, the dematerialisation of the work into an experience corresponds to the dematerialisation of the site-specificity of the work toward a site-oriented situation.

The virtual space explored through this work is a subjective space evoked by Artaud, which is an alternative to networked space and the synthetic world existing within computers. It provides new opportunities with a sonic approach contrasting with a visual one, for future research not only into virtual spaces (subjective and/or computerised) and cognitive neuroscience, but also new paradigms for perception in sound installations.

Music for Brainwaves
Performance

Fig. 3.5.1 Teufeslberg, Berlin (Forcucci)

Art and science are inextricably connected. Changing views of the manner in which nature operates bring about corresponding changes in art . . . If I imagine myself then as a composer in a situation where anything can be done, I imagine making a music a little different from the concerts of ambient sounds we nowadays hear wherever we are when we listen. I imagine this music as technically like my experience: wireless. I imagine all distinctions between art and life removed. Art would then have to do with the opening of ourselves to the world in which we live –
From a typed letter from John Cage to Billy Klüver

Creating new circuits in art means creating them in the brain –
Gilles Deleuze

Summary

The essence and inspiration of *Music for Brainwaves* came from Alvin Lucier's piece *Music for Solo Performer*. Neurofeedback and biological data are explored as components in the relationship among sound, space, and the body of the performer. There is actually an increasing interest in EEG[59] interfaces and neurofeedback, triggered by the speed of developments in technology and the latest discoveries in neuroscience. Such equipment was available only in university laboratories until recently, although now they exist as consumer goods or may even be built by those interested. The developments and discoveries have a great potential in sonic arts, since the perception of sound goes beyond merely its entering the ears to affecting the whole body. Although EEG registrations have been well explored for sound installations, music performances, and music cognition, relatively little is as yet known of the application of physiological data (EEG) within an ecosystem including sound, space, and perception by the performer and the audience. The latter is the approach taken by *Music for Brainwaves*. The piece relates to the *hyperbiological* space of the map of the project.

[59] Electroencephalogram.

3.5.1. Introduction

A nine-month residency at the Laboratory of Cognitive Neuroscience from the Brain Mind Institute at the Swiss Federal Institute of Technology in Lausanne informs the research. In this lab I, too, was:

> [I]nterested in the psychology of sound perception, memory and emotion, as well as their neural mechanisms. Obviously music and the brain was another interesting aspect for me. I learnt about neuro- imaging techniques that allow researchers to measure brain activity in behaving human subjects. I was especially fascinated by the recordings of electrical brain activity (electroencephalography, EEG) and how EEG experiments are designed. I further delved into topics such as how the body and self of the observer (of artworks) could be represented by the human brain. (Magistretti in Scott 2010: 105)

The investigations conducted at the Brain Mind Institute allowed a deeper understanding of the mechanisms related to EEG and their cognitive issues. However, the focus of *Music for Brainwaves* lies mainly on sound, space, biological data (EEG), and perception; neuroscience *per se* is not explored here. From a compositional point of view and in contrast to Lucier's *Music for Solo Performer*, where EEG triggers a physical movement on percussion instrument, *Music for Brainwaves* explores a sound continuum based on EEG data and generated by an algorithm. The continuum is based on Xenakis's algorithm *Gendy* adapted for the software Max / Msp[60], which produces a chaotic continuous sound that is, metaphorically and aesthetically, intended to reflect what the sound of the EEG or the neurons might be.

The *hyperbiological* space investigated by *Music for Brainwaves* is based on an interface employed in collecting physiological data from a performer. Then, the algorithm processes the collected data, and the consequent generated sound is projected in a (resonant) performance space; the result is heard by the performer, and thus included in a neurofeedback loop. In the present section, the definition of *hyperbiological* space will be introduced, and also how the

[60] Ported by Stephen Lumenta.

performer primarily perceives it**.** The section moves towards the definition of EEG, Neurofeedback and Brain

Computer Interfaces (BCI) and describes how, in the last decade, advances in technology and knowledge within the field have increased and thus augmented the presence of such devices. The section ends with the background and the origin of the piece influenced by Alvin Lucier's *Music for Solo Performer*; furthermore, it shows how, during the 1960s, such devices triggered curiosity among other composers. Today's issues are also introduced through the performers GX Jupitter Larsen and Stelarc. Section 3.5.2 presents the development of the piece from beginning with a collaboration with a cellist and a dancer until its final form as a solo piece. The section moves towards the presentation of the Brain Mind Institute, where the project initiated, and how an intense collaboration with neuroscientists into an art / science context is necessary to achieving such a project. Section 3.5.3 presents the development of the performance based on improvisation, body postures, and what these generate in term of sound in relation to EEG. The section moves toward the *Gendy* algorithm and the reason for this choice for this particular compositional process. Then, a first resumé, based on the questionnaire (developed at greater depth in Chapter Four) presents the patterns of the locations as these have been perceived by the audience. The section ends with the introduction of the ex-NSA listening station at Teufelsberg Berlin, where the more convincing reception of the *hyperbiological* space happened, and how this may relate to ancient sacred architectures in terms of resonance and perception. Section 3.5.4 offers a conclusion by discussing the development of the *hyperbiological* space and its reception by the performer and the audience. The chapter ends by providing future research plans in the field.

3.5.1.1. Mapping Hyperbiological Space

The *hyperbiological* space is an augmented peripersonal[61] space in a conceptual relationship of space, sound, body and physiological data (EEG). Considerations in higher-dimensional spaces are not discussed here, although research made in such areas is useful in understanding and perceiving abstracted dimensions related to a space where biological information is included, as described by Kiku:

> Some of the inspiration for Lewis Carroll's ideas most likely came from the great nineteenth-century German mathematician Georg Bernhard Riemann, who was the first to lay the mathematical foundation of geometries in higher-dimensional space. Riemann changed the course of mathematics for the next century by demonstrating that these universes, as strange as they may appear to the layperson, are completely self-consistent and obey their own inner logic. (Kiku 1995: 22, 23)

The space *sensed* through neurofeedback by the EEG performer includes the idea of the 'higher-dimensional space' expressed by Kiku. It appears when the performer hears, in a resonant space, the sonic result created by his own EEG. The related environment emerging from the process between sound, space and neurofeedback is the *hyperbiological* space. Clark describes the relationship between the brain, the body, and the world as follows:

> The brain's role is that it acts as a mediating factor in a variety of complex and iterated processes which continually loop between brain, body and technological environment (…) The intelligent process just *is* the spatially and temporally extended one which zigzags between brain, body and world (…) The machinery of contemporary human reason thus turns out to be rooted in a biologically incremental progression while simultaneously existing on the far side of a precipitous cliff in cognitive-architectural space. (Clark, n.d: 3, 6)

The *hyperbiological* space is a step after the *virtual* space explored and defined by the sound installation *Kinetism* in Section 4.4 (where the *virtual space* is

[61] 'Peripersonal space is defined as the space immediately surrounding our bodies' (Rizzolatti *et al.* in Holmes and Spence 2004: 94).

approached as an internal subjective experience). Now, in contrast, *hyperbiological* space is a complex dynamic subjective internal and external space in a closed loop provided by neurofeedback. Ascott proposes the term 'cyberception' in explaining the relationship between *our* selves and the mediated world, and how we are augmented:

> Cyberception involves a convergence of conceptual and perceptual processes in which the connectivity of telematic networks plays a formative role. Perception is the awareness of the elements of environment through physical sensation. The cybernet, the sum of all the interactive computer-mediated systems and telematic networks in the world, is part of our sensory apparatus. It redefines our individual body, just as it connects all our bodies into a planetary whole. (Ascott 2003: 320, 321)

Although the experience of augmentation of the self in *Music for Brainwaves* does not involve the telematic mediation through the Internet as proposed by Ascott, such a network already exists in the relationship among body, physiological data, sound, and space through neurofeedback.

3.5.1.2. EEG, Neurofeedback and Brain Computer Interfaces

EEG (electroencephalogram) measurements were first discovered by the German neurologist Hans Berger in 1924. EGG is the electrical activity of the firing neurons in the brain, and EEG measurements are mainly present today in the medical field for their role as:

- **Neurofeedback**

  By watching and listening to real-time multimedia representations of its own electrical activity, the brain can improve its functionality and even its structure. (Budzynski *et al*. 2009: xxi)

- **Brain Computer Interfaces (BCI)**

  Brain Computer Interfaces (BCI) monitor the activity of the brain for measurements. In the last decade it has improved as an extension of the body in order to control computers, prostheses or wheelchairs.

However, BCI appeared in many other domains such as video games, media art and music, among other fields. The next decade could unlock other

opportunities, according to Lance:

> Based on advances in sensor technologies, analysis algorithms, artificial intelligence, multi-aspect sensing of the brain, behaviour, and environment through pervasive technologies, and computing algorithms will be capable of collecting and analysing brain data for extended time periods and are expected to become prevalent in many aspects of daily life. (Lance *et al.* 2012: 13)

3.5.1.3. Background

The major influence of *Music for Brainwaves* comes from Alvin Lucier's piece, *Music for Solo Performer*. The technology was originally for military research and had no link with music, as mentioned by Lucier. The points of convergence rely on the idea of control and energy data present as a main component in *Music for Brainwaves*: The control of the body by the meditative state includes the energy (here as EGG) transferred to an algorithm:

> Dewan described to me this phenomenon that had to do with visualization, that by putting yourself in a non-visual state, it would be called a meditative state now, you could release the potential of the alpha that is in your head. It's a very small amount, but it would become perceptible, at least to an amplifier. (…) Actually, it doesn't sound like anything because it's ten hertz and below audibility; it isn't a sound idea, it's a control or energy idea. (Lucier 1995: 48, 50)

During the same period, composers and artists were collaborating with engineers to integrate new technology and thus discover new tools for new forms of music and art. A noteworthy example is a series of performances in New York in 1966 called *9 Evenings: Art, Theatre and Engineering* developed by artists and engineers and 'endeavoured to reassess a legendary series of ten experimental performances that was presented at New York's 69th Regiment Armory on East 25th Street in October, 1966' (Garwood 2007: 36). Among others there were the performances of Cage's *Variations VII*:

> Cage was performing an unscored work for the first time, attempting a live broadcast of all the sounds in the world at once. *Variations VII*, like other Cage compositions, departed from art-making as a purely pictorial process and moved it toward the spatial, experiential, and

> conceptual. This particular work highlighted the *soup* of invisible frequencies in the realm of immediate experience. (*Ibid*: 40)

Music for Brainwaves relates to Cage's work *Variations VII* through the '*soup* of invisible frequencies in the realm of immediate experience' described by Garwood, since the EEG performance includes invisible frequencies from the body performer into the performance space. Consequently, the vision of *Music for Brainwaves* relates to an attempt to bring brainwaves into the musical realm, which includes the notion of making an invisible activity perceptible for the audience. The quest includes long-term collaboration with scientists and engineers in order to develop highly specialised skills and provide new opportunities to investigate new questions in art, science and technology. David Rosenboom, Richard Teitelbaum and, later, Pauline Oliveros explored EEG for musical purposes as well around the same period, as described by Branden:

> Richard Teitelbaum would make use of amplified brain waves in both *Organ Music* and *In Tune* of 1968; and David Rosenboom, the composer perhaps most closely allied with brain wave music, would also begin his experiments in that area at the State University of New York in Stony Brook in 1968 (...) The composer, wired-up in various ways, would become the performer of and primary listener to the sounds produced. (Branden 2011: 132)

In addition Rosenboom describes the first experiments from the 1930s with EEG technology:

> While listening to his own alpha rhythm presented through a loudspeaker, Adrian tried to correlate the subjective impression of hearing the alpha come and go with the activity of his eyes (Adrian and Mathews 1934). Inevitably, artists with an experimental bent would come to apply this – and subsequent developments in brain science - to both artistic production and research in artistic perception. (Rosenboom 1990: 48)

Improvement of technology leads to more affordable devices; advances in neuroscience research from the last decade provide a growing interest in and rediscovering of music produced with EEG. Multiple directions emerged. Among

them, and in line with *Music for Brainwaves*, notable examples may be found in the work of:

- **GX Jupiter Larsen and his 'Wellenfeld' quartet**

  The quartet includes also Joke Lanz, Rudolf Eb.Er and Mike Dando. The sound and the procedures developed by this performance are close to those of *Music for Brainwaves*:

  > The performance took place without prior tests or rehearsals. The performer develops and gains control over his own brainwave patterns during the performance, by listening to the sonic results of his mental activity. By changing electric impulses of the brain during meditative and ecstatic trance, the performer begins to sculpt the sound through the mind alone. (Eb.Er, Lanz, Jupitter-Larsen and Dando 2014)

- **Stelarc**

  In our correspondence, Stelarc responded thus about his use of EEG:

  > My use of amplified body signals and sounds, including EEG- both for sound and control purposes- occurred primarily from 1972 to approximately 1986. These were amplified live as part of body installation performances (and from 1980 with my Third Hand).
  > I do not have a music background although I've always used sound in my performances. So there are no scores as such. The performances began when the body was switched on and they ended when it was switched off. The sounds varied through partly physiological control (control of breathing, state of relaxation and tension and muscle tension) and partly through body fatigue. So a cacophony of sound was generated that varied in complexity and density depending on what sounds were switched on and off and were happening separately or synchronously.

Furthermore, and according to an interview in 2001 with Linz, Stelarc mentioned:

> In the late '60s there was a lot of interest in biofeedback mechanisms (…) For me there was a desire to make sound as part of a body's motion. It wasn't a case of making the piece more dramatic through the use of sound, but rather that I'd always taken a multisensory approach to art. The premise of amplifying the body sounds was to articulate what's happening inside the body, and the possibility of monitoring these signals enabled a kind of structural relationship. (Linz 2001)

Music for Brainwaves relies, in terms of sonic aesthetics and improvisation, on works produced by GX Jupitter Larsen. The piece also relates to Stelarc's views with its aim 'to articulate what's happening inside the body, and the possibility of monitoring these signals enabled a kind of structural relationship'.

Music for Brain Waves is influenced structurally by action music,[62] since the work addresses the process of making decisions about artistic systems and how the body replaces the art object in determined environments. LaBelle cites Cage regarding this:

> Cage addressed the very act of making decisions, the artist being understood not so much as the maker of objects but as an individual in the act of making decisions as to what, how, and where art take place and the systems by which to initiate its production (…) In this sense, what follows from a Cagean outlook is an emphasis on process (…) The body literally comes to replace the art object, for it pushes up into the realm of form to such a degree as to explode definition and the literal lines of material presence. (LaBelle 2006: 54, 55)

Following LaBelle's claims, *Music for Brainwaves* includes not only the body as a work of art, but also the decisions from the composer articulated within the development of the performance through the following procedures and decisions:

1. Find a very resonant space;
2. Wear the EEG device and start the algorithm;
3. Sit for as long as you feel it necessary;
4. Then lie on the floor, for as long as you feel it necessary;

[62] 'Action-based music emphasizes the artistic exploration of mechanical actions, which are used to control all aspects of composition, including its conception, form, instrumentation and instrumental design, performance and score. Actions applied to sounding objects and actions of environmental phenomena thus can become the principal means for musical expression. The composer prioritizes exploration of performative actions as opposed to investigation of particular sonic parameters in the creation of this music (….) While performing action-based music, the player is, in fact, often instructed about how to and what to perform rather than what sonic effect to achieve' (Kojs 2009: 286).

5. Sit again for as long as you feel it necessary;
6. Take a text and read it mentally;
7. End the performance or start again from the beginning if you feel it necessary.

3.5.2. Context of the Work Itself

During the last decade a growing interest appeared in EEG interfaces and their potential in medical and the gaming industries, media art and music[63]. Today's technology is lighter and more affordable, and the interest resides in exploring potentials for:

- Music composition by going forward in the man / machine interaction and focusing on an ecosystem defined as *hyperbiological* space in the actual chapter;
- Including neuroscience research as an important component to push forward the creative process between art and science through long-term collaborations (Blanke, Forcucci and Dieguez 2009).

3.5.2.1. Three Situations

The dramaturgy of the piece, or its '*raison d'être*', resides in the idea of investigating the potential of a form of music generated directly by the body. How, in this context, can the audience perceive the movement and the influence of the brainwaves on the sound without relying on visual information? A direct relation between actions and reactions and their visualisation adds a too-predictable flavour to the composition – and probably a distraction from it. Instead, creating a focus on listening demands a greater participation from the audience; when it is approached as a change in the sonic cloud with artefacts in the sound, it could lead to

[63] 'In the medical industry EEGs are used to detect abnormalities in the brain such as epileptic seizures, and to stimulate the users' movement of wheelchairs. In the gaming industry they are used for neurorehabilitation. In media arts installation: 'Wave UFO' from Mariko Mori presented at the Venice Biennale in 2005. In music: the Multimodal Brain Orchestra performed in Prague in 2009' (Palmer 2009).

dedication rather than distraction, because the attention of the audience is directed towards few movements and events.
During the development phase of the project, trials included other performers, such as a cellist and a dancer. The former was very convincing in term of musical interactions and gestural presence towards the audience; the latter formally provided an interesting perspective, given the contrast between a moving dancer and an immobile EEG performer. Both ideas, and their visual contributions, were, however, abandoned in order to concentrate on a purely spatial relation among an architectural resonant space, sound, and the EEG performer.

Fig. 3.5.2 EEG Performer and Cellist (Forcucci)

Fig. 3.5.3 EEG Performer and Dancer (Hell)

Fig. 3.5.4 Solo EEG Performer (Forcucci)

3.5.2.2. Brain Mind Institute

In 2009, the Swiss Federal Office for Culture through the Swiss Artists in Lab programme granted me a nine-month residency at the Brain Mind Institute. The Brain Mind Institute, part of the Swiss Federal Institute of Technology in Lausanne, is an important brain research centre which 'aims to cover some key areas at different levels of neuroscience research and link with other institutes to create a comprehensive effort to understand the emergence of higher brain function' (Brain Mind Institute 2013).

The core part of the residency provided me with important knowledge about neuroscience, in order not only to work on an interface and sound produced by biological data, but to understand in greater depth the brain emitting the data. This was because I was interested to extend this research by investigating the addition of 'loop feedback' as a spatial component and to extend parallels between art/science from the 1960's with today's software and EEG (electroencephalography) hardware technology. Although neuroscience is a highly specialised and complex discipline, I was trained for nine months alongside PhD students, attending seminars and courses; I had the privilege of working with post-Doctoral researchers on experiments, was invited to weekly seminars held by the different labs, attended conferences, presented my ideas

to the neuroscience community, and had regular meetings with professors in order to push forward my research.

3.5.3. Composition

Music for Brainwaves is based on the *Gendy* algorithm from Iannis Xenakis, and implanted into the software Max / Msp. The performance relies on four different pre-defined parameters of *Gendy*, which structure the movements of the composition. The movements last three minutes each and are generated by the EEG waves. *Music for Brainwaves* is close to *Gendy3* (Xenakis 1994), a composition and an algorithm developed by Iannis Xenakis, and sonically close to what appears, for example, between 5' and 6'30'' in his composition.

3.5.3.1. Performance

Actions for the performance are pre-determined yet improvised in length, according to the performance space and the audience. Improvisation gives a more flexible range of possibilities; the actions (i.e. sitting, lying on the floor, and reading a text) provide:

- Different sonic gestures;
- Different states of consciousness, limited by the duration of the performance.

The algorithm is based on aleatory procedures and thus the results are not always predictable; they are mainly changes in the frequency, amplitude, and timbre of sound.

The differences in brainwave activity modulate the sonic cloud from the *Gendy* algorithm in the resonating space and the resulting sonic artefacts alter the sonic continuum. No action provides a direct effect on the sound, yet there is always a delay. In the same order of ideas, Birringer proposes the sensation of mediations in Prehn's work, as follows:

> signals generated through electro-physiological monitoring of vital data (…), Prehn strives to concentrate not on semiotic processes of sense-making but on the immediate physical and emotional experience of the *endo-movement,* so to speak, the movements

> inside the body. For Prehn, such experiences are transcendental, ecstatic. They even resemble the hypnagogic trance states one might experience in a 'ritualistic or liturgical' context (…) The performer's own immediate experience of multiple, simultaneous, fluid 'phantoms' of self or of the body's signs in motion: the immediate sensations of mediations. (Birringer 2008: 31, 33)

The points claimed by Birringer and relevant to *Music for Brainwaves* are:

- The interaction with the mediated environment 'with signals generated through electro-physiological monitoring of vital data';
- 'The immediate physical and emotional experience of the *endo-movement,* so to speak, the movements inside the body';
- 'The hypnagogic trance states one might experience in a 'ritualistic or liturgical' context';
- 'The performer's own immediate experience of multiple, simultaneous, fluid 'phantoms' of self or of the body's signs in motion: the immediate sensations of mediations'.

The above points are perceived primarily by the performer, hence the decision to define strategies to include the audience in the loop:

a) To analyse the perceptions from the audience (as presented in Chapter Five of the current research);

b) To perform in resonating spaces such the ex-NSA Teufelsberg Dome introduced in Section 3.5.3.4.

3.5.3.2. Xenakis's *Gendy* Algorithm

The choice of *Gendy* is based on the quest for a sonic aesthetic that develops a chaotic *continuum,* metaphorically intended to reflect the activity of the firing the neurons. Also, the idea of the performance relies mostly on the improvisation of bodily pre-defined gestures (put on the EEG device and start the algorithm; sit for as long as you feel it necessary; lie on the floor, for as long as you feel it necessary; sit again for as long as you feel it necessary; take a text and read it silently), which move according to pre-defined parameters derived from *Gendy.*

In these pre-defined parameters, the responsibility for generating numbers inside the algorithm is left to the computer:

> *Gendy* makes sound by repeating an initial waveform and then distorting that waveform in time and amplitude. Thus the synthesis algorithm computes each new waveform by applying stochastic variations to the previous waveform. (Roads 1996: 342)

Gendy is based on probabilities and on stochastic operations[64] (although linked to data and energy generated through EEG), as analysed by Serra:

> Stochastic music emerged in the years 1953-55, when Iannis Xenakis introduced the theory of probability in music composition. (…) Then Xenakis decided to generalize the use of probabilities in music composition (…) In the 1960s, Xenakis started to use the computer to automate and accelerate the many stochastic operations that were needed, entrusting the computer with important compositional decisions that are usually left to the composer. (Serra 1993: 237)

The algorithm itself is described here:

> The program is based on an extensive use of stochastic laws. This creates a homogeneous composition in which the microstructure and macrostructure are conceived through the same perspective, i.e. filling sonic space with sound material and structuring this space are accomplished with similar means. (*Ibid:* 255)

In this sense, 'filling sonic space with sound material and structuring this space are accomplished with similar means' has a strong metaphorical connotation with *Music for Brainwaves:* filling the physical performance space with sounds by using the sounds emerging from *Gendy* as a strong sonic impulse into the resonant space, done to trigger the *hyperbiological* space, which in turn leads to neurofeedback.

[64] According to Xenakis, 'Stochastics' studies and formulates the law of large numbers (…) the laws of rare events, the different aleatory procedures, etc. As a result of the impasse in serial music, as well as other causes, I originated in 1954 a music constructed from the principle of indeterminism; two years later I named it 'Stochastic Music.' The laws of the calculus of probabilities entered composition through music necessity' (Xenakis 1992: 8). The term used by most people is 'the study of probability along the time dimension'.

3.5.3.3. Relation to the Audience

The various audiences' responses are presented here as a resumé from the questionnaire related to the investigation into intention (composer) / perception (audience) and developed further in Chapter Five. The following patterns of perceived spaces / locations are observed in relation to the appreciation of the composition by thirty participants, who each listened to the piece only once; it relies on only one question about the relation between sound and perceived spaces:

- The places of the performance (a theatre, and an artist's studio) appear in eight answers;
- An open space (empty landscape, rocky desert, void, field) appears in five answers;
- Urban environments (traffic, walking into the crowd) appear in four answers;
- Water (rivers, seaside, ocean) appears in four answers.

The answers retained correspond to repeating patterns observed in the analysis of the questionnaire and therefore only those answers are considered.
A performance offers the audience visual images, whereas a sound-based piece hopes to stimulate the audience's own imaginations. However, there are some patterns that indicate a *sensation* provided by the brainwaves as an open space, considerable activity (urban environments) and flows of energy (water). The answers from the survey are developed further in Chapter Four.

3.5.3.4. Teufelsberg ex-NSA Listening Dome

During the research process, different architectural configurations (e.g. apartment, artist's atelier, theatre, and university laboratories) were tested, but none of them was resonant enough to *sense*[65] the *hyperbiological* space.

[65] To perceive the relation of sound and space through the whole body and as neurofeedback.

They sounded ‘dry’; a specific element was lacking from the neurofeedback, meaning that the sensation of the embodiment of the relation between sound and space was absent.

A church or a cathedral was the first logical choice because of the reverberant acoustic properties of such architecture and the musical past linked to the idea of a composer creating a piece with a specific building in mind.

However, an unexpected solution (in terms of acoustic properties) appeared in Berlin in May 2014: the ex-NSA Teufelsberg listening station in Berlin. The first impression during the performance in this space was the embodiment of the relation of sound and space through the physical sensing of the neurofeedback.

Listening here takes another completely and different perspective from that of surveillance during the Cold War from the West towards the former East of Europe. Although the concept of surveillance contextualises contemporary issues such as privacy and telecommunications, this research will not address such considerations. Here, the Teufelsberg listening dome is interesting only for its exceptional properties of resonance. Merill and Schmidt present the former listening station as follows:

> Primarily, the 115 metre high hill was planned to use for recreation. But right after the beginning of the Cold War it was occupied by the US Army due to its prominent position: in the middle of the enemy region. Since 1951 the hill served as a U.S. listening post and from 1964 onwards permanent buildings were erected (Grube, 2003). The field station was then used till 1990 by the U.S. Army & U.S. Air Force Intelligence together with the NSA for tapping and interfering with the radio communication of the Eastern Bloc. (Merill and Schmidt 2009: 23)

The performance of *Music for Brainwaves,* included in the documentation of the current chapter, was recorded in the almost spherical radome[66] on top of the

[66] Spheres used to protect and conceal radar antennas.

highest derelict tower. McIntyre-Burnie (in Cox and Ings) underlines some of the problems that may arise when documenting such works:

> Being in a space, gauging the distance between sound sources, walking through corridors and rooms, you subconsciously compensate for the way sounds from different locations arrive at different times in the ear,' says McIntyre-Burnie. 'Installations can make perfect sense in situ, but they can come apart in a recording, when there are no visual cues to help you. (Cox and Ings 2014)

Cox and Ings define the sonic properties of the Teufelsberg radome thus:

> Teufelsberg, on the outskirts of Berlin (…) a disused military facility contains 'radomes' -- spheres used to protect and conceal radar antennas. The highest radome is on the sixth storey of a derelict tower. Jump onto the concrete plinth in the centre of the room, and any sound you make is focused back towards you. Sway to the right so the focal point is at your left ear, and the amplification afforded by the curved walls lets you whisper into your own ear. (*Ibid*)

The acoustics of the place are so reverberant that it makes it difficult even to communicate with one another. When the sound of *Music for Brainwaves* was sent into the room, the neurofeedback became something unique that I experienced only in that particular location: The timbre of the sounds had changed, in contrast to all of the other places where it has been played, not only because of the resonant acoustics of the place, but also how it affected the amplification of my 'reaction' in the neurofeedback loop. I perceived truly an embodiment of the relation of sound and space.

Fig. 3.5.5 Performance Radome (Forcucci)

Fig. 3.5.6 Performance Radome (Forcucci)

The process emerging from *Music for Brainwaves* is obtained through physiological data extracted and processed by modern technology. However, similar resonant issues linked to physical perception and a similar embodiment seem already to have been discovered in ancient caves from the Neolithic period, for example, on Malta, as mentioned by Eneix:

> Researchers detected the presence of a strong double resonance frequency at 70Hz and 114Hz inside a 5,000-year-old mortuary temple on the Mediterranean island of Malta. The Hal Saflieni Hypogeum is an underground complex created in the Neolithic (New Stone Age) period as a depository for bones and a shrine for ritual use. A chamber known as 'The Oracle Room' has a fabled reputation for exceptional sound behaviour (…) resonant frequencies can have a physical effect on human brain activity. (Eneix 2014)

In addition, the resonant frequencies, which are of the same order as those experienced in Teufelsberg, are found also in other sacred locations around the world:

> Special sound is associated with the sacred: from prehistoric caves in France and Spain to musical stone temples in India; from protected Aztec codexes in Mexico to Eleusinian Mysteries and sanctuaries in Greece to sacred Elamite valleys in Iran. It was human nature to isolate these hyper-acoustic places from mundane daily life and to place high importance to them because abnormal sound behavior implied a divine presence. (*Ibid)*

Cook, Pajot and Leuchter suggest that further research should be conducted in order better to understand the links between resonance and emotional processing:

> Previous archaeoacoustic investigations of prehistoric, megalithic structures have identified acoustic resonances at frequencies of 95–120 Hz, particularly near 110–12 Hz, all representing pitches in the human vocal range (…) We evaluated the possibility that tones at these frequencies might specifically affect regional brain activity (…) These intriguing pilot findings suggest that the acoustic properties of ancient structures may influence human brain function, and suggest that a wider study of these interactions should be undertaken. (Cook, Pajot and Leuchter 2008: 95)

Such pilot studies are of interest for future investigation in order to

investigate potential relationships between resonances, frequencies, and neurofeedback.

3.5.4. Achievement, Conclusions

The development of *Music for Brainwaves* as a performance explored issues about an ecosystem emerging from a performer's body emitting physiological data as EEG, transformed into sound, sent into a resonant space and received back as neurofeedback by the same performer. The process leads to the term *hyperbiological* space, which relates to an augmented peripersonal space (by physiological data through sound in space) and the impression of sensing the relation of sound and space by the performer in the first instance, since 'the composer, wired-up in various ways, would become the performer of and primary listener to the sounds produced' (Branden 2011: 132).

The *sensed* space appeared in particular when sounds were sent into the resonant space of the Teufelsberg ex-NSA listening station; there was a clear impression of the embodiment of the sensed space. It has been shown that such experiences with resonating space existed from at least the Neolithic period and lead 'to isolat[ing] these hyper-acoustic places from mundane daily life and to attribute high importance to them because abnormal sound behaviour implied a divine presence' (Eneix 2014).

On the basis of the data from one single question in the survey, it has also been shown briefly – as will be emphasised in Chapter Five – that the audience concentrated mostly on the performer's performance, which therefore probably reduced the amount of vivid mental imageries. However, the patterns indicate a *perception* of an open space, with considerable activity and flows of energy, which is probably the perception of the data and neurofeedback by the audience. Further research must be accentued in very resonant spaces, since the most active sensation of neurofeedback, at least for the performer, is experienced in resonant spaces. The results of this analysis are limited since the various places of performance where the data were collected proved less resonant than at the performance at the Teufelsberg radome included in the

documentation, and where a limited audience was present, but no data was collected for logistical reasons; here, the most significant impression of *sensing* sound and space relationships was perceived by the performer.

Future directions for the research are found along the following paths:

- To investigate perceptive issues of the audience in selected resonant spaces;
- To emphasise art / science research in sonic arts and neuroscience in order to develop research into neurophenomenology: this appears briefly in the future research at Section 5.4;
- Meditation and states of consciousness in relation to resonant space (e.g. in ancient sacred spaces);
- The perception of sound and space investigated through neuroscience, EEG and fMRI analysis.

Voices from the Coalmine
Performance and Sound Installation

Fig. 3.6.1 10 KV Electrical Hall, Coalmine Interaktionslabor (Forcucci)

Lasting
Sounds leaving from
Different places and forming
Sounding
A sculpture which lasts – Marcel Duchamp

O Looking-glass creatures, quoth Alice, draw near! – Lewis Carroll

Summary

Voices from the Coalmine investigates real spaces as resonant filters, leading to a virtual space made of resonances. The resonances emerge from the projection of sounds into complex layers of spaces included within a process progressively transforming sound. The artwork is a hybrid between performance and sound installation. Metaphorically, the work encapsulates the memory of the voices of the activity of the former workers in the coalmine; furthermore, it investigates the perception of an autistic person. The challenging part of *Voices from the Coalmine* resides in the experience of an artwork that is process based, site-specific, ephemeral, and where no audience was present.

3.6.1. Introduction

The resonant spaces within the buildings of an abandoned coalmine in Göttelborn, Germany, are the environments in which found objects[67] (Fig. 3.6.1.) have been recorded. The piece was created during a residency with musicians, composers, dancers and a choreographer, with the goal of exploring issues of perception and autism.

[67] The objects were wagons for coal transport or structures from the steel buildings. They were used as percussion instruments in the different spaces of the location, in order to activate reverberation and resonance.

Fig. 3.6.2 Found object, gong (Forcucci)

The recordings made in various spaces of the coalmine were combined, edited, composed and consequently projected in the power plant[68] through four loudspeakers directed towards the walls. The result is recorded and re-projected several times, with each occurrence developing a new generation of recordings. Thus, the space itself becomes a progressively closer part of the sound by shaping[69] it. The process suggests an intrinsic relationship of sound and space.

The real and virtual nature of *Voices from the Coalmine*, the thematic of the research residency (autism), and the influences of the actual work will be introduced in Section 3.6.1. As a background, some historical examples already existing in the Middle Ages, although mostly instances from the mid-twentieth

[68] *10 KV Electrical Hall* is the name of the power plant of the coalmine.
[69] Meaning that the resonant frequencies of the sound are related to the space. Some frequencies are cancelled and others amplified according to the shape, material and dimensions of the space (*see* Section 3.6.1.3. and Alvin Lucier's remarks).

century, introduce the relation of sound and space as developed by composers and artists. The section continues by discussing process art, as well as addressing the relation of sound with architecture and art.

In Section 3.6.2, the context and the location will be introduced to emphasise the meaning of the piece, the memory encapsulated in the spaces of the coalmine and the hybrid nature (incorporating both the performance and the installation) of the work and its process. Section 3.6.3 presents the collection of the sounds and how these have been played in the different spaces. Next, a description of the set-up of the sound installation in the power plant, the sonic improvisation and the compositional process will follow. Section 3.6.4 concludes with the review of issues related to an ephemeral work based on process, the importance of documentation and archives of site-specific practices – more for their conservation than for the reproducibility of the artwork, since the documentation in that case is the work itself and thus questions the transfer of experience. Comparisons with Alvin Lucier's works, in particular *I am Sitting in a Room*, as well as with Cagean insights into architecture and art, are drawn.

3.6.1.1. Mapping of Real and Virtual Spaces

Voices from the Coalmine encloses real and virtual spaces.

Real spaces are of two kinds:

- The reverberant spaces of the architectures of the coalmine, where found objects were recorded.

a)

b)

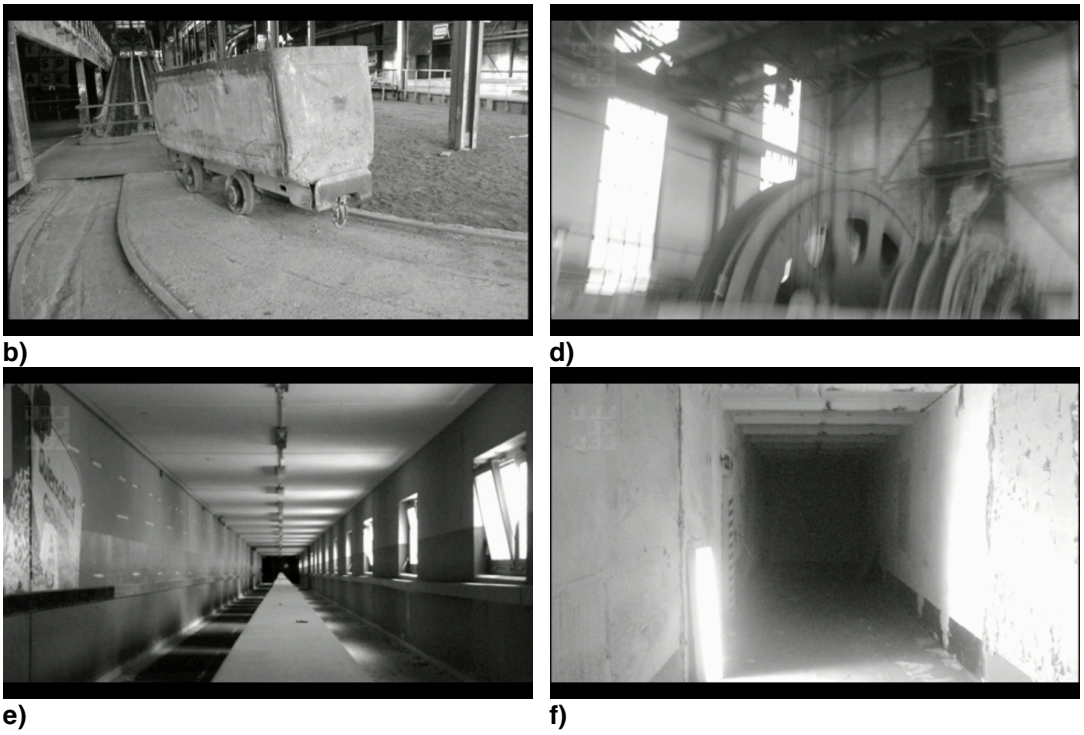

Fig. 3.6.3 Recorded spaces and objects from the coalmine (Forcucci)

- The *10 KV Electrical Hall* where the process of composition took place.

Fig. 3.6.4 *10 KV Electrical Hall*, loudspeakers turned towards the walls (Forcucci)

The virtual space is the constructed space emerging from the recording and projection process into the *10 KV Electrical Hall*: The consecutive projections of the sound of the coalmine's reverberant spaces through the four loudspeakers turned towards the wall and the consecutive result comprise several generations of recorded sound.

3.6.1.2. Autism and Perception

The context of the project investigates perception through autistic persons, and it was developed at Interaktionslabor, a laboratory for interactive media, design, and performance, on the site of a former coalmine in Göttelborn (Saarland) in Germany. Several artists were invited to work on a project based on autism:

> The title '*Halbinseln der Wahrnehmung*'[70] refers to a text edited by Uschi Schmidt Lenhard and Andreas Lenhard, proposed as research libretto for investigations into differing perceptual channels and psycho-social research on autism, synaesthesia, music composition and real-time performance (…) The acoustic-musical dimension of the 2009 laboratory is complemented by research into design or wearable audiophonics and acousmatic architectures and sound perceptions. (Interaktionslabor 2009)

Autistic persons are enclosed in their own world; they perceive the non-autistic world differently. *Voices From the Coal Mine* acknowledges the possibility of creating a bridge between the more generally shared viewing (or hearing) of the world and theirs by slowly transforming the sound of our reality into what would be the perception of an autistic person. The sounds recorded in the coalmine and projected in the *10 KV Electrical Hall,* and consecutively transformed by the generations of projections, are an artistic interpretation and metaphor, yet it is developed within the context of an autistic person's view:

> Then, suddenly, I see something – far, far behind the Milky Way. It looks like a plane made of glass, it is translucent, somehow. (Interaktionslabor 2009)

[70] Peninsulas of perception.

The subject of autism emerged as the main topic of the residency, where the project was developed. A consistent body of research exists about the correlations between pathologies and art, mainly in the visual arts and conducted by neuroscientists. The originality of *Voices from the Coal Mine* is found in the sonic approach and the investigation conducted by an artist. The starting point of the work resides in the following text '*Halbinseln der Wahrnehmung*'[71] transcribed by two German psychologists: Uschi Schmidt-Lenhard, a researcher, and film/radio producer, and Andreas Lenhard, a psychologist whose practice includes working with autistic persons (Interaktionslabor 2009). Through applying excerpts of their writings, the aim is to investigate, through sound and space, the perception of the world by an autistic person:

About Sybille - and the empathies of the Du Norm Menschen ('You-Norm People')
Fantasies of autistic people. 01 Jan (p.1)
My name is Sybille and I am autistic (Asperger's Syndrome).
I would like to show you a part of my world.
For this, I also need someone who can help me, to mediate between the worlds.
I somehow always need something, which is between me and you. Generally, in the everyday, I use a contact stick. In this case I also use Mr Lorenzen. He is a psychologist in the AutismAmb (ambulant service). I find him suitable for this.
(…)
Then, suddenly, I see something – far, far behind the Milky Way. It looks like a plane made of glass, it is translucent, somehow.
(…)
The first thing I notice is that many buildings are made of glass. It is a somewhat foreign, and yet so familiar, architecture.
(…)
It is strange, how quickly one finds oneself standing on the other side of the mirror. For a moment I enjoy the feeling, however. Then suddenly, there is a different feeling in me, somehow sad - empty, yes, almost shameful. I begin to think, ask myself whether on this planet there are also "You" people.
If yes, how would they live in the world in which autistic people are the norm?
...Ring, ring...My ears! Something is wrong with my ears.
A loud, shrill sound. - Then comes the emptiness.
- An **almost infinite emptiness later.'**
(Interaktionslabor Manuscript 2009)

[71] Peninsulas of perception.

The following sentences from the views of Sybille are explored:

- ‘Mediation between the two worlds.’

The two worlds are metaphorically the real spaces recorded in the coalmine (as a metaphor for our worlds), and the virtual one constructed through the several projections of sound against the walls of the *10 KV Electrical Hall* until sound is blurred by the space and therefore becomes a metaphor for the autist’s perception.

- ‘It looks like a plane made of glass, it is translucent, somehow.’

The sounds are reflected on the walls of the spaces, and processed by several generations of reverberation. They appear as if they were ‘looked’, i.e., seen (and in the case of the composition, they are heard) through translucent glass.

- ‘Standing on the other side of the world.’

The result of the processed sound (the progressive generations of sound) is a new sound where sound and space are blended as a consequence of the consecutive generations of projections and recording process. One can no longer distinguish the spatial information included in the sound (e.g. the resonant spaces). Instead, one perceives the result of the addition of generation of sound and space. This is a metaphor for Sybille’s perception of the world. The sounds are transformed from real ones to blurred ones as they might be perceived by Sybille through the translucent glass. The progressive transformation from one world to the other *is* the work and therefore the work is a metaphor for Sybille’s perception.

3.6.1.3. Background

The main influence for this project is Alvin Lucier’s work *I am Sitting in a Room*. There is a comparable and progressive blurring of sound by space. The focus lies equally in Lucier’s description of music in terms of wavelengths, and in relation to architecture, contrasting with the idea of higher or lower notes. This is, of course, not forgetting how space is capable of filtering sound, and why the impact of the dimensions and quality of space are important:

> The space acts as a filter; it filters out all of the frequencies except the resonant ones. It has to do with the architecture, the physical dimensions and acoustic characteristics of the space (…) Actually, there's no such thing as 'high' notes or 'low' notes, we simply borrowed those terms from the visual world (…) If the dimensions of a room are in a simple relationship to a sound that is played in it, that sound will be reinforced, that is, it will be amplified by the reflections from the walls (…) Thinking of sounds as measurable wavelengths, instead of as high or low musical notes, has changed my whole idea of music from a metaphor to a fact and, in a real way, has connected me to architecture. (Lucier 1995: 88)

Lucier emphasises the relation between sound and architecture, which is a central theme in *Voices from the Coalmine*. The idea may be identified in early examples of music that were composed with a particular building or architecture in mind. This is, for instance, observed in '1436 with Guillaume Dufay when he composed his motet for the dedication of the cathedral,[72] *Nuper rosarum flaures'* (Baumann 1990: 208).

In the middle of the twentieth century, contemporary composers such as Luigi Nono and John Cage held contrasted approaches on their use of space, sound and silence, although the architecture in their case is the concert hall, as described by Pape:

> In Cage's music, silence is used as a means to allow ambient sounds that are in the concert hall to be heard; in Nono's music, it is the reverberant and resonant characteristics of the space and of the music itself that are allowed to sound. Rather than putting emphasis on the sounds that happen to be in the concert hall by chance, as in Cage's music, Nono's silences are an intensification of his composed sounds. While Cage wants us to understand that 'music' already exists in the environment without any human need to compose it, Nono uses silence to intensify the sounds he has composed, to permit the acoustic space itself to sound, and to allow the listener's feelings to resonate and reverberate in the silence that follows sounds. (Pape 1999: 59, 60)

The Cagean notion of 'music that already exists in the environment' is present in the constant sonic humming of electricity of the power plant,

[72] Florence Cathedral.

contributing to the sonic identity of the place. On the other hand, *Voices from the Coalmine* includes Nono's consideration that 'silences [are] an intensification of his composed sounds'. The relation existing between sound, space and silence is integral when hitting sound objects in the abandoned buildings of the coalmine. However, Nono proposes the notion of space also as a compositional component; he does so not in the sense of spatialisation, but as an element in direct relation to sound, one that transforms its intrinsic quality and 'permit[s] the acoustic space itself to sound'. This is certainly an element of *Voices from the Coalmine*, too. The role of space and sound follows the idea already present during the Renaissance:

> The question of sound and space links Nono to Andrea Gabrieli, Giovanni Gabrieli and Thomas Tallis. The sensitivity of these three Renaissance composers to the necessity of writing a different type of music for each unique acoustic in order to make each space "sound' inspired admiration in Nono. (…) The space reveals, unveils, discovers, explores, makes live, is read by the sound, in which the space itself becomes music and the music is composed for and with the space (with traces of the Gabrielis and Talis): the music composes the space. (*Ibid*: 60)

The preceding examples are related to music composition and composers, whereas the following list includes artists with a plastic approach to sound: this means that it is considered beyond notes[73], with notions of space, environment and location. Therefore, ideas are proposed in relation to the notions of site-specificity, ephemerality and immateriality, as demonstrated in the examples below.

- **Bill Fontana**

Bill Fontana's works are site-specific and ephemeral. He proposes the relocation of sound from one context to another, the importance of the context to sound, and the relation between sound and architecture. These common

[73] Or as mentioned by Cage about sounds: 'those that are notated and those that are not' (Morgan 2011: 51).

elements reside in the idea of relocation, which indeed modifies the ambient sound source. Central considerations in *Voices from the Coalmine* are the a) occupation of sound field and b) sculptural as volumes of space. The difference between Fontana's criteria and mine is the context, which for my work remains the same, i.e. the coalmine. Fontana remarks:

> I began to realize that the relocation of an ambient sound source within a new context would alter radically the acoustic meaning of the ambient sound source (…) In both my field recording and sound sculpture, sounds are not isolated from their contexts; in relocating sounds I have been concerned with the contexts in which the sounds are placed and with the sculptural/spatial qualities of the sound source (…) The acoustic conditions and architectural qualities of such contexts have played important roles in my selection of sculpture sites (…) In addition to their sculptural ability to belong to a particular space, ambient sounds are sculptural as volumes of space in terms of how a given sound source occupies its own sound field. (Fontana 1987: 143, 144)

In *Voices from the Coalmine* the relocation means the diffusion, into the power plant, of the sounds recorded in the coalmine. The 'acoustic conditions' and 'architectural qualities' of the coalmine and the *10 KW Electric Hall* are central elements of the composition. The 'sculptural ability' and 'how a given sound source occupies its own sound field' are observed while being projected and re-recorded several times in the *10 KW Electric Hall*.

- **John Cage, *4'33"***

This piece marks a shift in terms of music definition and perception, because he emphasises ambient sound. More specifically, Cage states that environmental sound is music, too. The piece is also a precursor work of Cage in site-specific practice, as proposed by LaBelle:

> *4'33"* demarcates a time and a space in such a way as to underscore the meeting or gathering of occurrences as a locus, as a situational event with real bodies and real effects. Such a move is pre-cursory to what can be called 'site-specific practice', developed overtly within the arts of the mid- to late-1960s. Such practice draws upon the given parameters and situation and incorporates them into the

> making and presentation of the work itself. In this way, it is contextually aware, producing not so much an object of attention but a set of conditions by which context is brought into focus. (LaBelle 2006: 15)

In *Voices from the Coalmine*, parameters and situations are key to the development of the work, since sounds have been collected in the coalmine and re-projected into the power plant. LaBelle's mention of 'producing not so much an object of attention but a set of conditions by which context is brought into focus' is paramount in the current piece.

- **Max Neuhaus, *Drive In Music***

The piece proposes idea of site specificity in term of factors that often have an influence on perception: humidity, time of the day or even the speed of a car, to name but a few. Therefore, ephemerality relates to the unique temporal experience of the participant, according to LaBelle:

> *Drive In Music* from 1967 is considered Neuhaus' first sound installation. Situated on Lincoln Parkway in Buffalo, the installation consisted of a series of seven radio transmitters located intermittently along a half-mile stretch of the roadway. Each transmitter broadcast a particular frequency, thereby defining a particular area or zone of the roadway by giving it is own sound signature. Listeners could hear the work while driving down the roadway, tuning into the specific radio frequency, each sound mixing and overlapping as one drove through one zone and into the next. *Drive In Music* existed in the ether, as material picked up by an individual car radio and mixed by the driver's speed, location, and trajectory (…) Neuhaus' installation works are contextually specific, appropriating a given spatial situation and turning it inside out, revealing its properties through invigorating perception (…) The activation of perception through sound may draw attention to space, its material presence and any perceptual phenomena, yet it does so by activating our memory of spatial experience. (LaBelle 2006: 155, 159, 164)

The affirmation that '*Drive In Music* existed in the ether' is central within *Voices from the Coalmine*, since the work is unique in terms of moment in time and cannot be experienced twice. However, the idea of activating

perception through sound and drawing attention to space is equally central.

3.6.1.4. Process Art

The link with fine arts relates to the idea of the plasticity of sound and its sculptural aspects. The link also refers to process art through its progressive transformation of sound by space and the inherent procedures. Therefore, the process is the work. This art movement emerging in the mid-1960s, is defined as follows:

> Process art emphasizes the 'process' of making art (rather than any predetermined composition or plan) and the concepts of change and transience, as elaborated in the work of such artists as Lynda Benglis, Eva Hesse, Robert Morris, Bruce Nauman, Alan Saret, Richard Serra, Robert Smithson, and Keith Sonnier. (Guggenheim 2013)

I am Sitting in a Room is the major reference for the actual work and the idea of process and generation is properly included, as explained by Lucier:

> I didn't choose to use tape, I had to, because in order to recycle sounds into a space, I had to have them in some form (…) it changes from generation to generation until it reaches the point of diminishing returns (…) I was interested by the process, the step-by-step, slow process of the disintegration of the speech and the reinforcement of the resonant frequencies (…) it's playing the speech back into space. The signal goes through the air again and again; it's not processed entirely electronically, it's also processed acoustically. (Lucier in Lander and Lexier 2013: 193,194)

The process of composition in *Voices from the Coalmine* includes the ideas of 'step-by-step' and 'the reinforcement of the resonant frequencies'.

3.6.1.5. Sound and Architecture

Voices from the Coalmine is a performance and sound installation with a combination of complex layers of sound and space that progressively overlap and blend with each other. The work implies a connection among sound, space and architecture, from a Cagean point of view, when he refers to the architect

Mies van der Rohe's *Glass House*, and including Duchamp's ideas found in *The Large Glass*, as proposed by Lebel:

> The design of the *Glass* thus can never be seen *by itself,* apart from its surroundings, but it is inscribed, as it were, like the other image of a double exposure, ceaselessly transformed by a background of reflections in which that of the spectator himself is included. This effect of transparency plays an important part in Duchamp's conception for he has turned the background into a ready-made continually in motion (...) To exhaust all explanations since they are to be found, providing we can decipher them, in the very structure of the *Large Glass* in the form of two circulatory system which communicate with each other only by signs. (Lebel 1959: 68, 71)

Voices from the Coalmine is a long process of generation and transformation of sound by space, and the relationship with *The Large Glass* resides in a 'background of reflections' (e.g. the reverberations of the sound in the several spaces of the coalmine and the several reflections in the *10 KV Electrical Hall*). Metaphorically, 'the two circulatory systems which communicate with each other only by signs' illustrates the communication between the two worlds (the autistic one and that of others).

Fig. 3.6.5 La traversée du grand verre (*Through the Large Glass*), 1966 (Duchamp)

The issues, found in the works of Mies van der Rohe and Duchamp, echo Sybille's sentence from Section 3.6.1.2: 'It looks like a plane made of glass, it is translucent, somehow.' Cage, too, refers to Mies van der Rohe's architectural

relations to the environment, as influenced by Moholy-Nagy, and through the idea of spatial relations instead of volumetric ones, according to Branden:

> In Mies van der Rohe's architecture the observation of the environment is to be understood as a result of the reflections cast across the glass surfaces of the building. In this reformulation of transparency in terms of reflection, Cage returned to what was undoubtedly one of the primary sources of his interpretation – the discussion of architectural space presented by Laszlo Moholy-Nagy in the book *The New Vision*, the importance of which Cage stressed on more than one occasion.
> As defined in *The New Vision*, truly spatial relations – as opposed to volumetric ones – were only achieved by modern architecture through the mutual interpenetration of the interior and exterior of the building. While Moholy-Nagy did reference the physical openness and flow of space in certain modernist buildings, he repeatedly presented his concept of architectural space as a consequence of the play of external reflections. (Branden 1997: 87)

Mies van der Rohe's thoughts on transparency are present in Cage's iconic piece *4'33"*. The ideas are of silence, and the interpenetration of the interior, exteriors, and the reflections of the surroundings. This is also prevalent in the composition of *Voices from the Coalmine* with a recombination of recorded spaces: the interpenetration of the interior (the power plant) and exterior (the coalmine) results in mutual reflections of spaces in the process of composition, shaping the sound through acting as a resonant filter. Branden mentions interpenetration in Duchamp's and Mies van der Rohe's work:

> For Cage, any silence in Miesian architecture would not negate the environment but would open the building up to an interpenetration with its surroundings along the lines of Cage's own definition of silence. Indeed, Cage figures the transparency of Mies's glass buildings as a metaphor for his own goal of eradicating harmonic music's alienation from the plane of everyday existence. (…) Cage's aim of collapsing art into life was not a renewed faith in the transgressive facticity of the unassisted readymade but instead an investigation into the modalities of transparency that brought Duchamp closer to Mies van der Rohe. (*Ibid*: 89, 92)

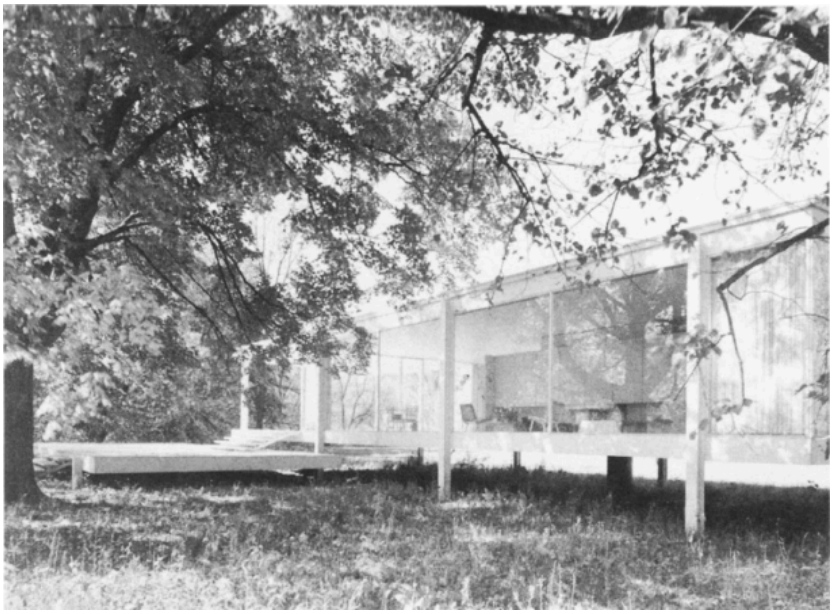

Fig. 3.6.6 Ludwig Mies van der Rohe, Farnsworth House 1945-51 (Branden)

3.6.2. Context of the Work Itself

Voices from the Coalmine took place during a research residency at Interaktionslabor[74] in Göttelborn during the month of August, 2009. The residency is located in an abandoned coalmine, now a centre for start-ups and technology. Autism implies a difference in perception; my proposal highlights such perception in providing a blurred aspect of sound and space, as if looking metaphorically through an opaque window. By analogy it allows a progressive view that develops from our world into the autistic one. The sounds progressively shift from having their distinguishable spatial properties towards blended sounds incorporating indistinguishable spatial information. The sound of the spaces of the coalmine (triggered by found objects) is progressively transformed from a clear perception into 'another', altered, perception in the *10 KV Electrical Hall* power plant.

[74] A laboratory for interactive media, design, and performance, on the site of the former coalmine in Göttelborn (Saarland, Germany).

3.6.2.1. Coalmine and Power Plant

The memory of the coalmine, its past function and history rely on a precise context, which 'frames'[75] the work. Haraway proposes that site-specific sonic practices include not solely phenomenological aspects, but also anthropological ones:

> Situated sonic practices take into consideration not only aspects of the built environment, architectures and social spaces, but also the temporal dimension of space as expressed through memory and history. They thus privilege contested modes of knowledge such as 'the experience of sound' and other embodied objectivities and 'situated knowledges'. (Haraway in Ouzounian 2006: 72)

Furthermore, the space of the power plant has a sonic identity encapsulated into it: the constant humming sound of the electricity together with the singing of the birds coming from outside. The found objects from the coalmine relate, in contrast, to the memory of its past function. The combinations of the humming, the birds and the sounds from the found objects act as memories between the past and the present of the location.

3.6.2.2. Performance and Installation Conservation

According to the map introduced in Section 1.7.2 of the present research project, *Voices from the Coal Mine* is the only piece of the portfolio that is at one and the same time a performance and a sound installation. The result of the process is also proposed as a fixed media piece for documentation purposes, together with samples of different generations of projections into the *10 KW Electric Hall*. Since the work *is* the process, the documentation relies mainly on elements describing the process. The absence of an audience during the process echoes Kaprow's comments about happenings and the elimination of the audience:

> It follows that audiences should be eliminated entirely. All the elements – people, space, the particular materials and character of the environment, time – can in this way be integrated. And the last

[75] The memory of the location, which is a coalmine, provides a range of mental imagery of hard labour, underground smells, and different air pressure, all within the dark environment of the coal.

> shred of theatrical convention disappears. For anyone once involved in the painter's problem of unifying a filed of divergent phenomena, a group of inactive people in the space of a happening is just dead space. It is no different from a dead area of red paint on a canvas. Movements call up movement in response, whether on a canvas or in happening. Happening with only an empathic response on the part of a seated audience is not a happening but stage theatre. (Kaprow in Bishop 2006: 103)

What if experience is provided solely through documentation? The idea is provocative, although it relates to issues experienced with changes of technology in media-based art in recent history and questions the validity of the conservation through documentation only of a performance work.

3.6.2.3. Contextual Processing

The gradual process of combinations of sound and space is part of the work. It refers to Lucier's description of *I am Sitting in a Room* about the degeneration of the original sound through an acoustic process:

> Often, people don't understand the process. They think that the same speech is dubbed from one recorder to another and each time the quality of the copy degenerates a little bit. But it's not that at all, it's playing the speech back into the space. The signal goes through the air again and again; it's not processed entirely electronically, it's also processed acoustically. (Lucier 1995: 88)

The gradual transformation of the sound by the *10 KV Electrical Hall* space is perceptible after each generation of recording. The space slowly shapes the sound injected into the hall, and the sound magnifies the space during the recording. Two constant sonic presences are shaped and interfere with the recordings as 'spatial counterpoints'[76]: one is the constant singing of the birds and the other the humming of the power plant, which after recording are not only integrated into the process, but are also present at each projection.

[76] By this, I mean that they are not included in the sound projected by the loudspeakers; they are emitted from another source elsewhere in the space.

3.6.2.4. Shaping Sound(s) by Space(s)

The idea of shaping sounds by the spaces of several locations relies on Smalley's considerations such as those of spaciousness, the occupation of space by sound, spectral ideas, providing insights for a spatial discussion and how space interacts with sound. In this context, Smalley cites Lefebvre about space:

> Neither a mere 'frame', after the fashion of the frame of a painting, nor a form or container of a virtually neutral kind, designed simply to receive whatever is poured into it. Space is a social morphology: it is to lived experience what form itself is to the living organism, and just as intimately bound up with function and structure. (Lefebvre in Smalley 2007: 38)

Smalley particularly mentions the relation of sound and space (and therefore my idea of sound shaped by space) by insisting on energy deployed into the space:

> Space is concerned with energy and its release, energy which '*has* to be deployed in space' (Smalley's italics), and physical space 'has no "reality" without the energy that is deployed in it: energy modifies space or generates a new space'. This is precisely how spectromorphologies, however directly or marginally source-bonded, function with regard to space in acousmatic music. Sounds in general, and source-bonded sounds in particular, therefore carry their space with them – they are space-bearers. (*Ibid*: 38)

Sound shaped by space has to do with Smalley's definition of spectral space, according to pitch space and in particular tonal pitch space.[77] After a few generations of projections into the *10 KV Electrical Hall*, the original spaces encapsulated into the sound disappear. During the process, the *10 KV Electrical Hall* enforces its own frequencies, since 'by playing sounds into a room over and over again, you reinforce some of them more and more each time and eliminate others' (Lucier 1995: 88). The remaining frequencies of sound no longer contain 'spatial' information; instead, they became a drone sound, their own entity *per se*.

[77] 'I regard tonal pitch space as a subset of spectral space because it is founded on a particular subdivision of spectral space into incremental steps that are deployed in intervallic combinations, and we are able to discriminate clearly the different interstices that result' (Smalley 2007: 45).

3.6.3. Composition

The core of the piece resides in its process, which is examined in Sections 3.6.3.1 to 3.6.3.4.

As a performance the piece is an improvised session between a jazz musician[78] and the author. The improvised session is based on sound collected around the coalmine during a soundwalk. The sounds were selected and classified as families of sounds fitting together in terms of tone, timbre, and nature, for example.

As a sound installation the piece is a device composed of four loudspeakers directed towards the walls of the power plant, for sound projection and reflection. It is site-specific and the characteristics of the space (including its reverberations and reflections) define the future nature of the piece through encapsulating the 'memory' and 'voices' of the place. As an aesthetic result, the sound of the impact of the objects (bottles, steel, the concrete structure of the coalmine, and other found objects) being clashed against each other is smoothed by the projection of the sounds into the space and the consecutive generation of recordings[79]. After the third generation of projections of sound in space, frequencies start to be reinforced (the lower ones) and others tend to be eliminated (the higher ones). Reinforcement and elimination of frequencies relates to the definition of smoothed sound.

3.6.3.1. Collection of the Sounds

The first phase of the composition process is a sonic walk around the several spaces of the coalmine. The spaces are chosen according to their respective variable reverberations and resonant qualities activated by found objects, such as the gong (Fig. 3.6.1), metallic structures of the buildings (Fig. 3.6.2) and Larsen feedback created between headphones and recorder. A voice is also recorded. It refers to the text of Sybille with the following sentence: 'Something

[78] Stefan Scheib – Liquid Penguin.

[79] As proposed by Lucier, in Section 3.6.1.3. of this chapter, 'by playing sounds into a room over and over again, you reinforce some of them more and more each time and eliminate others' (Lucier 1995: 88).

is wrong with my ears'. The sentence is recorded in Portuguese, French, German, and English during the first projection of sound into the *10 KV Electrical Hall*.

a) **b)** **c)**

Fig. 3.6.7 Situations for voice recordings in the *10 KV Electrical Hall* (Forcucci)

3.6.3.2. Set-up

The set-up for the diffusion of the sounds in the power plant is located in two places:

- The mixing board from where the first combination of sounds is created and then sent to the loudspeakers for six consecutive generations of recordings.

a) **b)**

Fig. 3.6.8 Sound control in the *10 KV Electrical Hall* (Forcucci)

- The *10 KV Electrical Hall*, where the recordings are made through four loudspeakers projecting the sound against the walls. In the middle of the room, two microphones record the result.

a) b) c)

Fig. 3.6.9 Loudspeakers and microphones in the *10 KV Electrical Hall* (Forcucci)

3.6.3.3. Improvisation with Sounds

The sounds were collected in different spaces of the coalmine, then selected and classified according to their characteristics (for example, their tone, timbre, density of the material, nature of the sounds, eclectism of the spectrums). The classification was decided quickly after the soundwalks by the author and Stefan Scheib, and based on our recent memories of the recorded spaces. The sounds were then shared between two performers and played with a live sequencer (Ableton Live software). One of the performers is a jazz player, and improvisational aspects from that particular music form are usually based on a) defined and known standards, or b) fully improvised (free jazz). The analogy with the current piece is found in a mutual knowledge of sound characteristics and properties (e.g. standards) gleaned and combined through the soundwalk and recordings, providing a common perception of the sounds and the spaces, yet at the same time freely improvised in a specific situation and location.

3.6.3.4. Compositional Process

The compositional process of the piece includes a sonic exploration, with the following rules, of spaces and objects encountered in the coalmine:

- Walk and explore architectural spaces of the coalmine;
- Try out the sonic quality of the encountered spaces with found objects (bottles, steel, the concrete structure of the coalmine, and other found objects) being clashed against each other;
- If interesting enough (in terms of spatial qualities), play and record them;

- If not, continue to explore;
- Compile the sounds as a library of families of sounds;[80]
- Share them with another performer;
- Improvise with the sounds and record the session;
- Project the recorded session into the power plant building through speakers directed against the walls;
- Record the result and project it again;
- Repeat the operation until the spaces and sounds sound as one single entity.

3.6.4. Achievement; Conclusions

The major achievement of *Voices in the Coalmine* relates to the communication of a process-based artwork that has been created when no one was present other than the performers. Since it is site-specific and a recording will not provide the full experience, only an impression of the work, then the documentation is mostly for the conservation of the work – as well as comprising the work itself. This is achieved through writing, pictures and sounds. Sol Lewitt stresses the importance of documentation against that of the work itself:

> All the steps in the process are of importance. The idea itself, even if not made visual, is as much a work of art as any finished product. All intervening steps -scribbles, sketches, drawings, failed works, models, studies, thoughts, conversations- are of interest. Those that show the thought process of the artist are sometimes more interesting than the final product. (*Radical Art* 2012)

Voices from the Coalmine is unique in its observations of the relations between architecture and sound. In particular, it addresses notions of spaces that are not volumetric entities, but instead relations that exists between different kinds of spaces. Those relations are based, in this context, in the interpenetration of

[80] Sounds with equivalent properties (timbre, tone).

internal and external spaces observed in the architecture of the *Glass House* by Mies van der Rohe and *The Large Glass* by Marcel Duchamp.

This is materialised by the action of space as a resonating filter for the sound through several generations of projection. The piece pays a tribute to Alvin Lucier's work *I am Sitting in a Room*; also, in contrast, and even if instructions are known[81], the work concentrates on the uniqueness of the moment, as proposed by Nyman:

> Processes throw up momentary configuration which have no sooner happened than they are past: the experimental composer is interested not in the uniqueness of permanence but in the uniqueness of the moment. (Nyman 1999: 9)

The process of composition is unique since we decided to record specific places, play the sounds in a specific manner, and record them in a moment when sounds happening outside of the *10 KW Electric Hall* were being recorded at the same time. Therefore, such conditions are unique and can never be reproduced exactly.

The relevance of Lucier's work is concentrated in the processes revealing the characteristics of the spaces and locations, which has been achieved in the present work in two ways: by magnifying space by sound, and by reaching an intrinsic relationship (after several generations of projection of sound into the *10 KW Electric Hall*):

> In all of Lucier's pieces, whether they are concerned with enclosed spaces, extended open spaces, environmental sound, voice characteristics or vibrating surfaces, he sets up open processes to discover the particular characteristics of the materials or areas he has selected, and what distinguishes them in different settings. The emphasis on processes is important as this enables one to explore the signature of each location or substance for its own impermanent uniqueness with needing to compromise or package the 'discovery' as a research document. (*Ibid*: 105)

Finally, a key aspect of *Voices from the Coalmine* relies on the conceptual approach of perception based on autism. This underlines that a sound work,

[81] Not for scoring purposes, but for conservation.

even with considerations on the acoustic properties of the site in which it stands, may also encapsulate ideas that are beyond phenomenology and anthropology, such as issues on alternative perceptions based on the different circumstances of each individual listener.

Chapter Four
ANALYSIS OF INTENTION / PERCEPTION DATA

Summary

The analysis of the results from the Intention/Perception (In/Pe)[82] project data relies on a questionnaire that investigates the perception of architectural spaces, as well as natural environments, in mental imageries; also, it focuses on common patterns emerging from the listening process of the portfolio included in Chapter Three. The analysis includes three fixed-medium pieces, one sound installation, and one performance. The piece *Voices from the Coal Mine* is excluded due to its ephemeral and unique site-specific nature, as detailed in Section 3.6.

4.1. Methods

4.1.1. Participants

There were at least thirty participants for each piece.[83] The number was determined by the sample size of participants observed in phenomenological research: Creswell mentions five to twenty-five candidates (1998: 64) as an adequate sample, Morse recommends at least six (1994: 225), whereas Mason claims that thirty-one is the number emerging from his study about sample size and saturation. In addition, in his studies Mason found that:

> While these numbers are offered as guidance the authors do not tend to present empirical arguments as to why these numbers and not others. (Mason: 2010)

Therefore, having thirty candidates for the current study falls within the range of the sample size used for phenomenological research.

The candidates were recruited while in art residency in China (although no Chinese-national participants were interviewed) and at universities in the UK, Germany, and Brazil. Candidates were chosen mainly from among students in music, sound studies, media art, and art, as well as established artists, musicians, composers, and curators; only a small fraction were not

[82] This is the name given to the analysis project of the current research.

[83] The sound installation *Kinetism* includes twenty-one participants, due to the complexity of the set-up of the sound installation and its availability. However, according to the sources on phenomenological research, such numbers are still acceptable.

professionally involved in the arts. The choice of candidates relies primarily on their potential respective abilities: as artists to represent objects in space, and for musicians, because they perform well in visuo-spatial tasks (Brochard *et al.* 2004: 103, 104, 106, 107, 108).

The relation between their professional backgrounds as regards their perception is not analysed, yet it provides information about their familiarity with experimental forms of art and music.

The participants were introduced to the aims of the research before the listening sessions. No information about the pieces was provided; this was omitted deliberately in order to avoid influencing their answers. All participants gave written consent for the study according to the protocols of the human research ethics policy of De Montfort University, Leicester, UK. These were approved by DMU's relevant committee. None of the participants was paid.

4.1.2. Experimental Set-up and Procedures

The participants in the three fixed media pieces, *The Fall, De Rerum Natura* and *My Extra Personal Space,* were sitting in a darkened room in front of two loudspeakers in my art studio in Shanghai, China and in two different classrooms at the University of the Arts in Berlin, Germany. The listening sessions included two to fifteen persons to which a maximum of two pieces in succession were played, and lasted no longer than forty minutes.

Twelve participants in *Music for Brainwaves* attended the performance in a darkened theatre at the University of São Paulo (UNESP), Brazil, and nineteen in my darkened art studio in Shanghai, China, seated in front of two loudspeakers.

Ten candidates attended the *Kinetism* sound installation in a darkened performance space and walked among eight loudspeakers (four for the environment and four for the heartbeat and the breathing) at the PACE building at De Montfort University in Leicester, UK. Eleven candidates attended *Kinetism* in a darkened classroom and walked among six loudspeakers (four for the

environment and two for the heartbeat and the breathing) at the University of the Arts in Berlin, Germany.

The participants in all of the pieces were mostly European or American (even in China), one Japanese studying in Germany, and a small proportion of South Americans. Such distribution made no significant difference to the results of the data and is therefore not incorporated into the current study.

4.1.3. Questionnaire

The questionnaire investigates perceptions of architectural space as well as natural environments in mental imageries through two main aspects. Firstly, what the participants experienced: 'this is called a "textual description" of the experience – what happened – and includes verbatim examples' (Creswell 2007: 159). The questions asked:

a) Which architectural spaces or urban environments, moving vehicle or moving persons and natural elements were perceived through visualised mental images;
b) In which locations, architectural spaces or natural environments the participants envisioned themselves while listening?;
c) Which types of sound made the participants think of a particular location, space or environment?

Secondly, the perceived experience that emanates from the portfolio, the intention of the compositions, performance and sound installation as proposed in Chapter Three. The procedure 'is called "structural description" of the experience, and the inquirer reflects on the setting and contexts in which the phenomenon was experienced' (*Ibid*: 159).

The questions are linked, meaning that patterns of perception of architectural spaces, locations, and environments may be observed through the three questions and thus verified through repetitions of patterns. Patterns emerging from the questions are a way for 'methodological rigor through the application of verification, validation, and validity' (*Ibid:* 270). The results are finally cross-

compared between the pieces in order to find additional patterns, as presented in Section 4.3.

The participants were requested to explore the spaces they perceived during the listening experience. In that respect, Landy, in the context of the Intention/Reception project, claims that dramaturgy (or its '*raison d'être*') 'helped them to better understand the music's motivation and finally understand the music itself' (Landy 2012: 15). In addition, the relation between the listening and the making is a an important concept since:

> Understanding involves feedback coming from your peers as to whether your intentions have been received and, when this is not the case, it involves the search for new means to make the intention/reception loop more successful (…) Although the creative act is the final goal, the creative experience of listening, making and understanding is the ultimate level enabling this final goal to be achieved (…) Your own evaluation and analytical comprehension of your work contribute immeasurably to this understanding. (*Ibid:* 178)

In the Intention/Perception project, the pieces are played only once, since the idea is to acquire the *first impression* of the audience through a survey. However, there is no modification of the pieces according to the responses given to the questionnaire. The study thus combines practice-led with audience perception feedback in order to investigate the loop between composer's intention and audience's perception.

The three questions retained from the questionnaire regarding the perception of architectural spaces emerge from observation of the methodologies developed by neuroscientists during experiments in body perception and conducted in virtual environments at the Brain Mind Institute in Switzerland. The questions are partially inspired as well by the Intention/Reception project[84] (Landy 2006; Weale 2006). The goal is to develop a phenomenological approach to architectural spatial perception, induced by sound and based on qualitative research; it is in contrast to auditory mental imagery research conducted through neuroimaging techniques such as EEG and fMRI and related to studies

[84] The project is detailed at Section 2.3.

into psychological and neural mechanisms (Bunzeck *et al.* 2005). The goal is not to 'answer the question of how it becomes active' (Zatorre 2007: 29). However, neural mechanisms are paramount in music education, as underlined by Zatorre:

> Musical imagery is important to musicians, so an understanding of its neural basis may help us understand aspects of expertise as well as provide some useful information for music educators. (Zatorre and Halpem 2005: 11)

The aim of the qualitative data analysis from the current research is to understand whether, through closing the loop through the listening process by exploring the mental imageries and the related architectural patterns emerging from the answers, the intention of the composer is indeed perceived by the auditor. Architectural mental imagery in electroacoustic contexts may, therefore, provide useful information on perceptual spatial issues in relation to a given composition.

4.1.4. Dropped Questions

The questionnaire submitted to the participants initially included questions on the quality of the piece (relaxing -3/stressful +3, pleasant -3/unpleasant +3, happy -3/sad +3, musical -3/not musical +3) as they experienced its effect on them. The participants were asked to answer by value on a *Visual Analogue Scale* (VAS) going from -3 to +3, and then to describe the reason. Zentner and Eerola propose that:

> The intensity of perceived or experienced emotions may sometimes appear to be more continuous than is implied by discrete steps, such as 'none', 'slightly', 'moderately', and 'extremely' (…) The *Visual Analogue Scale* (VAS) captures intensity of feeling by avoiding discrete jumps. Commonly it is a horizontal line, 100mm in length, anchored by word descriptors at each end (e.g. 'not at all joyful', 'extremely joyful'). The subject marks the point on the line that they feel represents their perception of their current state. (Zentner and Eerola in Juslin and Sloboda 2010:190)

This scale and the related choice values were directly inspired by experiments conducted in neuroscientific contexts while in residency at the Brain Mind Institute in Switzerland, the questions are also based partially on the Intention/Reception project (Landy 2006; Weale 2006). However, the results were not convincing in terms of homogeneity. That is, they were spread along the +3/-3 visual scale from one extreme to the other with no significant patterns. The questionnaire also included questions which asked a) if the participants had the impression of being in contact with their bodies; b) if they saw any part of their bodies moving; c) if they were in a static or moving position in their mental imageries; d) from where they did imagine themselves looking towards the perceived images; e) if they saw many locations, spaces or environments, and if so, whether they perceived them simultaneously or sequentially. Those questions were designed to investigate the neural mechanisms of body perception, and were chosen as well on the basis of observations made during experiments by neuroscientists conducted at the Brain Mind Institute in Switzerland. Those experiments were about mental rotations[85] (Ionta *et al*. 2013) and the original initial idea, for the current research, was to investigate them through sound.

I decided to concentrate the analysis on the research question of the current study, concerning the quality and typology of the perceived architectural and environmental space, and the responses to which are analysed below.

4.1.5. Data Analysis

The answers of the participants are grouped by patterns of analogue answers, in the context of architectural spaces, motions (of vehicles or people), and environments, 'allowing for the emergence of themes common to all participants' (Creswell 2007: 270). The same participant may answer with more than one pattern to the same question. Poor data are considered as those not answering

[85] 'How do people mentally represent and manipulate physical objects in their minds? Shepard and Metzler (1971) conducted one of the earliest experiments to investigate the use of spatial representations' (Marek, n.d.).

the question or being incoherent (e.g. ‘There was no reference for me to begin’, ‘lots’, ‘many’, ‘random thoughts’, ‘Not too far, but far away enough to not be touched by the noise’); for Question c), giving information about the sound although not the related locations/spaces or *vice versa*, such data are not retained.

4.2. Results

4.2.1. *The Fall*

a) While you listened to the piece, did you visualise images? Which ones?

Table 1

Architectural / Urban Environments	**Moving Vehicles / Moving Persons**	**Natural Elements**
- Industrial building, warehouse, abandoned space, factory, hall 8/35 participants-23% ***- Cave*** 3/35 participants-9% ***- Tunnel*** 2/35 participants-6%	***- Airplane, aircraft, helicopter*** 5/35 participants-14% - ***Train, metro*** 5/35 participants-14%	***- Water, sea, rain or dropping water*** 16/35 participants-46%
Answers not retained		
Radio, distant choir / Light filtering through the holes of the building / Images of blood in the body, milk flowing into a milker, virgin forest, dream-like pictures that quickly faded again / Sand / Organ-church music (very old organ) like chamber music / An airport terminal finger / Navigating in the space – navigating in the placenta as if embryonic / A submarine, darkness / Colour association with sound, abstract shapes / Churches / Floating energy, light / Non-descriptive, hard to explain, more abstract shapes and patterns / I tried to imagine the room and the sound sources / Moon landscape, fire camp / Pouring molten material / Outer space, a glass of water / There was no reference for me to begin / No mostly I don’t visualize while listening		

Perception of water and trains are related to the direct perception of sounds as these arise in the composition. In contrast, the answers referring to architecture

rely overall on the perception of a 'dark architecture'[86] and are, as well as with aircraft perception, personal mental constructions, since those did not exist in the recordings.

b) In which locations, spaces or environments do you see yourself while listening?

Table 2

Locations / Architectural Spaces	Natural Environments
- Big hall, big space, abandoned fabric, hangar 8/35 participants-23% ***- Cave*** 6/35 participants-17% ***- Sewer, tunnel under a big town, a shelter, worm holes*** 4/35 participants-11%	***- Landscape, field, green highlands, desert*** 8/35 participants-23% ***- Under water*** 4/35 participants-11%
Answers not retained	
Forest, night / It fell apart when the dripping sounds were scattered / Beaches / UFOs flying low and searching / I was watching this movie / First in an earlier situation from today, then in the present / During the piece I was very relaxed and I could let thoughts wander and I thought about the Expo 2000 (Hanover), there are acoustic sounds I never heard before / On a cliff / Fast changing landscapes / On a chair	

The perception of 'dark architecture' appeared again in the answers (abandoned fabric, hangar, cave, sewer, tunnel, shelter, worm holes), increasing from the previous question to a proportion of 51% of the participants, and thus confirms the previous answer.

While water is a direct perception of the sound present in the composition, the field, landscape, green highlands, desert, and 'dark architecture' are mental constructions since in such places no recordings were made.

[86] 'Dark architecture' refers here to abandoned buildings with poor light, industrial buildings or underground confined spaces such as a tunnel or cave.

c) Do you remember one or more particular sounds making you think of one/more locations, spaces or environments?
If yes, which sounds and which locations, spaces or environments?

Table 3

Sounds	**Related Locations / Spaces**
- Water flowing	***=> River inside a mountain, controlled movement inside a pipe, building, great tube space – sound, dense space in water like womb, underwater*** *11/35 participants-31%*
- Dripping / Cuts	***=> Cave, concert hall, a ruin, warehouse, tunnel, rainy day*** *9/35 participants-26%*
- No	***=>*** *8/35 participants-23%*
Answers not retained	
Footsteps on a large floor / On earth, in a plane / A place used to be used by people and is now back in nature's hand; this was the most concrete image I got / Cracking fire sound, beach flames / Moon space, fire, cities / Crackling of a very close fire / Modulated sounds in outer space	

The sound of water was a recurrent element in the answers and triggered various images of spaces in almost two thirds of the participants:

- Flowing movements related to spaces like a river inside a mountain, inside a pipe, building, dense space;
- The dripping/cuts related to cave, wet room, concert hall, ruin, warehouse, tunnel.

Consecutively, architectural spaces exist as two types of mental imageries in *The Fall*:

1) Big space such as a hall, warehouse, industrial building;
2) Smaller spaces such as a cave, tunnel, pipe.

The sound of water (flowing underwater and dripping) triggered the perception of the architectural spaces mentioned here, which is verified by its appearing regularly through the three questions.

The main sounds considered for this piece during the composition (Intention) were from a train station and the inherent braking of the trains, a lake with waves, a river arriving in the lake, and dripping sounds from a staircase, thus there is a link between the intention and the reception.

The idea of the piece relies mostly on the relation between a physical sculpture and a sound composition as described in Section 3.1., which together generated a unique space that appeared only during the premiere of *The Fall* when the audience was surrounded by eight loudspeakers in front of the sculpture. There was, clearly (due to its ephemeral and site-specific nature), no trace of the sculpture in the audience perception during the data collection, because the analysis relies on the composition itself and not on the piece as it was originally presented on site.

4.2.2. *De Rerum Natura*

a) While listening to the piece, did you visualise images?

Table 4

Architectural / Urban Environments	**Moving Vehicles / Moving Persons**	**Natural Elements**
- Confined concrete room, inside the earth, cave underwater, underground room, tunnel, descending underground 6/30 participants-20%	***- Bulldozers*** 3/30 participants-10%	***- Forest, jungle, trees science fictional ancient nature, subtropical forest*** 16/30 participants-53% ***- Water*** 8/30 participants-27% ***- Thunder, thunder clouds, natural disaster*** 5/30 participants-17% ***- Birds*** 5/30 participants-17%
Answers not retained		
Rocks, a car, airplane, orchestra, stamp of animals, chainsaw, car key, lawn mower, weed cutter, spaceship, standing under a corrugated roof, modern		

aircraft / Indians running, walking in fog / Sounds of a distant village, bell tower / Time galaxy screen saver / The sky, life in height but also in depth, the countryside, the city / Running persons, landscapes / Train, a boat, a coast / Abstract forms in movement and converting from 2D to 3D, sometimes pictures from books and fairy tales / Bells, landscape near a church / Universe, earthquake, mud, animals / Frogs, insects, mangrove, ocean, groups in nature / Roots, organic composition, animals patterns / The central Asian steppe / Africa / Skid of a boat offshore, rainbow / Wind

The perception of nature is directly related to the sounds as these are presented in the recordings. In addition, the participants perceived a confined closed space underground, which is a constructed space and not in any way present in the recordings.

b) In which locations, spaces or environments do you see yourself while listening?

Table 5

Locations / Architectural Spaces	**Natural Environments**
- Middle of a black space, dark space, cave, underground house space, underground, in the middle of a kind of tunnel 6/30 participants-20%	***- Forest, jungle*** 14/30 participants-47% ***- Water*** 7/30 participants-23%
Answers not retained	
At times taken to a place, like my junior school, theatre, airplane, car park / Observing the landscape from far, then closer. Some sounds so close that almost made by myself / Middle of noise, always dark as in early evening / To my parents, on the lawn, in the fields / Sculptures, abstract colour forms, lots of lights and smells / Old church near a forest / Sky, earth / Field, streams, subway / Foam in different scales (micro / macro) / Woods / Cosmos, clouds / I am located like in the space with a view on the lowland, away from what is happening in front of me / Not too far, but far enough away not to be touched by the noise	

Nature, as in forest and water, is a direct perception of sounds from the composition. This feature confirms the answers from the previous question. In contrast, the black, confined, underground space is a mental construction (a

virtual space) since no such place was the site of any recording – which also confirms the answers given to the previous question.

c) Do you remember one or more particular sounds making you think of one/more locations, spaces or environments?
If yes, which sounds and which locations, spaces or environments?

Table 6

Sounds	Related Locations / Spaces
- Birds	***=> Amazon, forest, meadow forest*** 7/30 participants-23%
- Light Rain	***=> Mountains, forest*** 6/30 participants-20%
Answers not retained	
- Rain/thunder made me think of Johannesburg (South Africa) thunderstorms, viewing from home, inland (South Africa); *- Car alarm/locking sound, grocery store, parking lot* *sitting in an arcadian setting, engulfed by fog – until the steamrollers come along, sounds of bells (but very close and loud);* *- Sound of tempest, pirogues on the water;* *- A dog imitating the sound of a bird => In the countryside, farm;* *- Metallic sticking shapes, hanging waving textiles, stretching rubber-like forms, whale stomach, walking inside an organ;* *- Diving underwater => excitement of what to find in the world of the unknown, crescendo of animals' literation => safely witnessing behind a tree trunk, no fear, only joy;* *- Do you know 'un altro Ferragosto' (by Alvin Curran)? I have a similar listening experience on this composition;* *- Movements of tectonic plates, Movement of beams of a boat or abandoned house, sound of extra-terrestrial beings, lighting mutation;* *- Roaring sound => Shell / subway;* *- Geometric compositions and organic according to the bass sounds of storm or insects;* *- Sound of thunderstorm, Sound of 'Bells': temple, Sound of Labour;* *- The beginning: summer landscapes with distant drums, heavy rain on a summer day, a crystalline room in the outer space, birds and crickets, water in many forms;* *- Working the land, construction of a shack, dig the foundations;* *- Frogs => Distress, Mystery, not peaceful;* *- Distant airplane;* *- Diving up from the deep river and observing many pigs eating;* *- Beginning and end were the most visual – can't remember the sound; I got lost in my head in between.*	

The architectural space perceived in *De Rerum Natura* is a black, confined space such a cave and is underground, as mentioned consecutively in Questions a) and b). However, no particular sounds were linked to the space mentioned in Question c).

The main sounds considered for this piece during the composition (intention) were from nature (water, birds, frogs, and insects) from field recordings made in the Brazilian Amazon Rainforest. The piece explores deep listening as a method for composition during the recording process in order to create vivid images for the audience. The intention is confirmed by the answers.

In addition, the piece interacts with the space of performance when presented as a concert, and therefore *De Rerum Natura* is site-specific for each performance space. The recording proposed to the participants was from a concert; the analysis of perception relies only on the composition and not on the piece as it was originally presented in the performance space.

4.2.3. *My Extra Personal Space*

a) While you listened to the piece, did you visualise images?

Table 7

Architectural / Urban Environments	**Moving vehicles / Person**	**Natural Elements**
- Industrial plants, factories, harbour 10/33 participants-30% ***- Small town, old town, village by the sea*** 8/33 participants-24%	***- Plane, helicopter*** 6/33 participants-18%	***- Ocean, seaside*** 18/33 participants-55% ***- Birds*** 12/33 participants-36%
Answers not retained		
Metal, glass, bells / Church / Apocalypse now! At the start of the piece & the movie. Bells made me think of how I imagined the setting of Captain Correli's Mandolin (I have only read the book). Bottle sounds made me think of an outside yard in the sun / In the background the city disappears in a golden body, walk in the dark and go back to the city / In a social disease. The sound recording was curious, touristic and off-set from the place described / A high contrasted sunset. Quite dark, standing on a		

lighthouse / Landscapes and light ambiences / Always in B/W, a whole narrative not always linear. A person (not visible) working outside in the factory / Dark skies, dark sea, solar eclipse, empty streets, just one man really disturbed from inside, walking and running around / A man doing handworks, cars going by / Animals, town, bottles bursting / Images issued of landscapes where I grow up: fields, forest, farm / Landscapes, nature, skylines / Different transitional scenes, various shades of black and white forming spatial entities / Ducks / Many replaced the others instantly, too many to describe / My hometown, the fish market / Travel in train, Grandfather playing with child in a shelter, interstellar flowers blossoming, remembering of past moments, throwing bottles in a recycling container / Then a pack of dogs, then someone striding through a field / Death, dock, the sky, kids, animal, deposit / A creative atelier with an artist doing sculptures, city / Landscapes, but different, forest – mountains / Bottle in trash, recognizable sounds + the rest is also unconsciously visual but abstract for words / I saw baby birds waiting for food. I was looking down at them, so I felt like I was the bird to give them food / Rocks, jetty, urbanity

The natural elements (seaside and birds) and the moving vehicles (aircraft) relate directly to the perception of sounds as they appear in the composition. Industrial plants, factories, a harbour, a small town, an old town, or a village by the sea, even if very close to reality, are, however, mental constructs. That is, no particular activity was recorded in Etretat (the coastal town), apart from the sea, the birds, and the sound of walking on the pebbles. The hypothesis for such a perception could be induced by merging the soundscape of Paris with the sounds of the coast (birds and seashore). Accordingly, the perception of nature in this composition is greater than the perception of the city: a large town is never mentioned in the answers; instead, the urban sounds are associated with industrial activity in a small or coastal town.

b) In which locations, spaces or environments do you see yourself while listening?

Table 8

Locations / Architectural Spaces	Natural Environments
- Factory, harbour, industrial plant, port city 7/33 participants-21% ***- Village, small town*** 6/33 participants-18% ***- Internal space (building, atelier, beach house, shelter)*** 5/33 participants-15%	***- Ocean, beach, seaside*** 15/33 participants-45%
Answers not retained	
On a desert island / Outside always, at the end felt much cold like England / In the water, back in a flat / Someone makes me listen to something / In the hospital / Always outside, sometimes there is an unclear image (transition) / From everywhere, from first-hand experience 'mostly', but also from environments from many angles / Some places of my childhood / In the sky looking down. Then seeing nothing clearly until arrival at the next destination / Some flashlight of scenes, but mostly, an abstract rather wide/universal space / Public space / Sometimes I am in my head, and other times I concentrate on the 'outside' – what is happening on the outside / In China, far from the original place / Yes travel in train / Interstellar flowers blossoming / Remembering of past moments / Throwing bottles into a recycling container / Flying, forest hills, valleys / I don't see myself, I see stuff but in an abstract/synaesthetic way. In my mind these are also related to concrete geographic spaces, but in a semantically (unrelated) unorganised way / Walking in a landscape / All black	

The natural environment (including the ocean, beach, and seashore) is related to the perception of sound as presented in the composition, and is thus a confirmation of the previous answer, although at a slightly smaller percentage. The locations and architectural spaces (the factory, harbour, industrial plants, port city, village, and small town) are mental interpretations of the perceived sounds, which is also a confirmation of the previous question even if also to a lesser extent. Finally, the most interesting point in relation to the perception of

architectural space, and even if it appears only as a very small proportion, relies on the description of an internal confined space.

c) Do you remember one or more particular sounds making you think of one/more locations, spaces or environments?
If yes, which sounds and which locations, spaces or environments?

Table 9

Sounds	Related Locations / Spaces
- Seagulls, waves =>	***Sea, coastal, village by the sea*** 19/30 participants-63%
- Metal =>	***Factory*** 9/30 participants-30%
- Footsteps =>	***Beach*** 8/30 participants-26%
- Bells =>	***Church, small village*** 6/30 participants-20%
Answers not retained	
Birds, stones / Animals, everyday sounds (breaking bottles), it was the more direct sounds / The birds flying over me. I heard three times / I had a lot of memories, moments from the past, all the same like cohesion. Like many travel in train / Grandfather playing with child in a shelter / Interstellar flowers blossoming / Remembering of past moments / Throwing bottles into a recycling container / I remember the paces, but not necessarily the sounds. Places from childhood, places I've been lately, general abstraction of things I've seen / Looking towards space / Dirty city with dirty business, Crickets => War, a researcher, Train => Far West, NYC	

My Extra Personal Space is a piece exploring convergences of timbres from natural (Normandy coast) and urban (Paris) contexts in France. The piece includes soundwalking as the main procedure through which to investigate, to listen to, and to compose with the environment.

The main sounds considered for this piece during the composition (intention) were from the nature (water, seaside and birds, seagulls, craven and dense flock of sparrows) and from several locations in the city of Paris. None of the participants mentioned a big city; rather, they had the perception of industrial plants or a small coastal village, meaning that nature takes the lead in

perception. In particular, there is the interesting example of the sound of bells, recorded in the surroundings of the St. Louis Island in the centre of Paris (e.g. Notre Dame Cathedral), which was perceived by the participants as a church in a small village. Three types of architectural spaces appeared as mental imageries in *My Extra Personal Space*:

1) Internal space (building, atelier, beach house or shelter);
2) Factory, harbour, industrial plant or port city;
3) Church.

The architectural space perceived in *My Extra Personal Space* as an internal space (building, atelier, beach house, shelter) is linked to no particular sound, while the factory and the related industrial spaces are linked to metallic sounds, as is the church to the bells.

4.2.4. *Kinetism*

a) While you listened to the piece, did you visualise images?

Table 10

Architectural / Urban Environments	**Moving Vehicles / Moving Persons**	**Natural Elements**
- Market 7/23 participants-30% ***- City, streets*** 5/23 participants-22% ***- Church, cathedral*** 3/23 participants-13%		***- Body, self, pulsating lung/heart, breath*** 7/23 participants-30% ***- Forest, nature, park, trees*** 6/23 participants-26% ***- Water (fall), river*** 5/23 participants-22%
Answers not retained		
A snowy landscape, S-Bahn, and the hall of a S-Bahn station [S-Bahn is a train in Berlin] / The environment around me was slowly becoming blurry as if there was smoke effect in the room / No, although I misheard and misidentified several sources		

The patterns from the answers are exactly the sounds as these arise in the sound installation: there are no interpretations.

b) In which locations, spaces or environments do you see yourself while listening?

Table 11

Locations / Architectural Spaces	Natural Environments
- Urban environment, city, streets, construction site, harbour 11/23 participants-48% ***- Market*** 4/23 participants-17%	***- Park, countryside*** 5/23 participants-22% ***- Inside human body / box / room (closed space)*** 3/23 participants-13%
Answers not retained	
Outside (waterfall) inside / S-bahn overground train station / busy small village, no traffic / next to the river, canal / In a dark alley and then to move open familiar space, safer space with familiar external sound, voices, cars, bells / Within the environment the piece takes me / Hospital / Mixed locations	

All of the answers reflect the perception of the sounds as they are in the composition, with the exception of those related to the body, the sounds of the heartbeat and the breath; these show the perception of a closed space, and this is a mental construct.

c) Do you remember one or more particular sounds making you think of one/more locations, spaces or environments? If yes, which sounds and which locations, spaces or environments?

Table 12

Sounds	Related Locations / Spaces
- Voices (Kids, market yellers)	***=> City, market*** 11/23 participants-48%
- Bird	***=> Nature*** 9/23 participants-39%
- Heartbeat and breathing	***=> Internal space (Dreamy fluffy, like when one starts to sleep), body, comfortable space, nauseous palpitations*** 6/23 participants-26%
- Bells	***=> Church, cathedral, an English village*** 4/23 participants-17%

Answers not retained
- Birds, zoo / animal store / metro doors / traffic (unrelated sound to places); *- Train sounds => train station;* *- Water => waterfall;* *- Treptower Park (Berlin) => river;* *- Bikes, wind, sound of the ground (dirt/earth) => I heard no room (reverb);* *- S-bahn station (Berlin) => the reverb of the surrounding room, sound of the closing door of the S-bahn (overground train);* *- General fullness of sounds => outside;* *- The river and rowing athletes.*

The spaces and locations perceived in *Kinetism* are exactly the same as those presented in the sound installation; the patterns in the responses repeat throughout the three questions. The perception of architectural spaces exists as mental imageries in *Kinetism* as:

1) An internal space related to the sound of the body, and thus the possibility of a self-identification with the sound of the recorded body. (a few participants mentioned that they consciously tried to achieve the same rhythm of the breath or the heartbeat);
2) A church or a cathedral, triggered by the sound of the bells.

The central idea of the piece was to explore the convergence of internal and external sounds in order to create a temporary zone experienced by the participant while s/he was walking into the installation, and thus leading to a virtual space. Such a space is difficult to express in words, and the participants were unable to describe it accurately and consistently. However, the closest description of a virtual space such as this has been proposed through the sound of the heartbeat and the breathing, which induced an internal space (dreamy and 'fluffy', as when one is starting to fall asleep), body, comfortable space or even the impression of nauseous palpitations.

4.2.5. *Music for Brain Waves*

a) While you listened to the piece, did you visualise images?

Table 13

Architectural / Urban Environments	**Moving Vehicles / Moving Persons**	**Natural Elements**
- The performance space (No images) 7/30 participants-23%		***- Water (Sea waves, waterways, ocean, heavy rain, floating, fishing vessels in stormy weather, a river, water flowing)*** 7/30 participants-23% ***- Dots on TV screens, electric representations (Thunder, wavesforms), electronic equipment*** 6/30 participants-20% ***- Human Body (Blood cells, Radiography of a pulsating brain,synapses connections)*** 3/30 participants-10%
Answers not retained		
Traffic / Galaxies, Battles in Star War movies / A pane washer / Attendance of other noise concerts / Death / Very abstract / Walk, sand, insect tunnel		

The piece is a performance. During this, the audience focused primarily on the performer and the performance space. That is, mental imagery is less immediately present, although there is to a small extent the perception of water in different forms and electric/electronic activity, relating to the sounds themselves (water) or the interpretation of the brain activity (electric/electronic activity).

b) In which locations, spaces or environments do you see yourself while listening?

Table 14

Locations / Architectural Spaces	Natural Environments
- In the place of performance (hotel room or theatre) 9/30 Participants-30% ***- Room (apartment, closed room, dark room)*** 4/30 Participants-13% ***- Urban environment (Traffic, highway, walking into the crowd)*** 4/30 participants-13%	***- Vast environment (empty landscape, kind of void, rocky desert, field)*** 5/30 participants-17% ***- Water (Waterway, river, rapids, seaside, ocean)*** 4/30 participants-13%
Answers not retained	
Outer space / On a rock watching an atomic bomb drop, because it was an atom bomb explosion and that's the only place one will survive / Difficult relation with the space, on one side the performer and on the other the receivers / Brain Space and other space that I can't define / A chaos of dark colour like a huge mixture of painting and me deformed with them / Swan, group of bats, airport / Outside, inside	

The pattern of responses regarding the place of performance increases statistically from the previous answer. The water perception is still present, but in a smaller proportion. Some participants saw themselves in locations that are not present in the sounds: mental constructs such as a room (apartment, closed room, or dark room), urban environments or landscapes.

c) Do you remember one or more particular sounds making you think of one/more locations, spaces or environments?
If yes, which sounds and which locations, spaces or environments?

Table 15

Sounds	**Related Locations / Spaces**
- No 21/30 Participants-70%	
Answers not retained	
- Yes, overall it made me think of the echoes of the big bang you can hear in old TV screens or speakers, thus reminding me of cosmic backgrounds and environments; *- If Images came, they were triggered by the words, but that wasn't places, only flashed images. For example, when wars are mentioned;* *- Yes, the explosion sound in the beginning;* *- No, but the flashes reminded me of a science experiment I saw on television: I think it was talking about Edison / Faraday (not sure) and electric experiments they did on themselves;* *- Antonin Artaud / His drawing and his vocal experiments. Some ideas of him, Illumination;* *- Yes, the text at the end of the performance took me away from that abstract space, like cooling down;* *- Inside the stomach;* *- Ocean, waves.*	

A majority of participants related to no location or architectural space that linked with the sounds. The nature of the piece is a performance and, as already mentioned, the audience focuses on the performer and his actions (sitting or lying on the floor and reading a text).

In this piece, neurofeedback and biological data are explored as components in the relationship among sound, space, and the body of the performer. The performer is the main audience; the neurofeedback is properly perceived only by him, who in the context of this survey is a particular position, since the intention of the composer and the perception of the audience are the main concerns. However, and this appears in Question b), the audience, even if only a small proportion, perceived:

- A room (closed space);
- Urban environments;
- Vast environment;

- Water.

The room (closed space) is the key point of interest. As regards the three others answers (urban environments, vast environments, and water), my hypothesis considers those sounds as an interpretation of the neurofeedback as perceived by the audience.

4.3. Discussion

The current analysis of the data through a qualitative inquiry provided a positive answer to the question of the research, which asked whether participants have a common perception of architectural spaces as mental imageries while listening to the portfolio of electroacoustic works included with the present report. The spaces appeared as follows:

Table 16

Piece	Perceived Architectural Spaces
The Fall	• Large spaces: Hall, warehouse, industrial building • Small spaces: Cave, tunnel, pipe
De Rerum Natura	• A black, confined space (such as a cave, and underground)
My Extra Personal Space	• An internal space (building, atelier, beach house or shelter) • An industrial space (a factory, harbour, industrial plant or port city) • A church or cathedral
Kinetism	• An enclosed space (inside human body, box or room)
Music for Brain Waves	• A room (apartment, closed room or dark room)

When cross-analysing the data among the different pieces, the common perception of the architectural space appears as a small confined dark space such as a cave or an underground space. The interpretation of such a pattern is the possibility that visualising any space compares it to the internal space of the

body. Although in *The Fall* a similar space also appears, that one is mostly linked to the dripping of the water and the related resonant sound.
In addition, the same architectural patterns of industrial buildings appear in *The Fall* and in *My Extra Personal Space*, which may be triggered by the sound of the brakes of the trains in *The Fall* and by the soundscape of Paris in *My Extra Personal Space.*
The intention to include the body in all of the compositions in the portfolio is perceived by the audience. The sonic elements linked to the body are footsteps in *De Rerum Natura* and *My Extra Personal Space,* brainwaves in *Music for Brainwaves,* and the heartbeat and breathing in *Kinetism.* Other and equally conceptual aspects are the relationship between the body, while soundwalking, the spatial perception, and the environment as found in *The Fall*, *De Rerum Natura*, *My Extra Personal Space,* and *Kinetism.*
The questionnaire and the In/Pe project in general were effective because they observed architectural mental imagery as spatial imagery. Firstly, studies into mental imagery triggered by sound tend to relate to auditory mental imagery – even in the absence of sound, as claimed by Zatorre and Halpem:

> Diverse studies converge on one principal finding: that neural activity in auditory cortex can occur in the absence of sound and that this activity likely mediates the phenomenological experience of imagining music. (Zatorre and Halpem 2005: 9)

In contrast, in the present study, the focus lay on the spatial mental imagery triggered by sound works. Sound and space are in this circumstance therefore closely related, since such spatial mental imagery might not occur without the sound. Such studies includes neuroimaging techniques in order to measure internal activity and phenomena:

> One can observe the underlying neural activity more directly, rather than inferring its presence. Yet, we are still left with the conceptual problem of knowing what is being measured. (*Ibid*: 9)

The originality of the In/Pe project focuses on mental imageries induced by sound, combined with a methodology that is based on qualitative and phenomenological concerns in the representation of architectural and spatial

perceptions. In other words, the approach of cognitive aspects and neural mechanisms of mental imagery must be approached by the experts and tools of neuroscience. However, the quality of the phenomena and possibly their interpretation could be emphasised by the current methodology, which investigates the typology of the perceived spaces. The In/Pe project shed light on such issues according to the discoveries provided by the results. Similarly, Damasio proposes the idea of mapping as the main methodology of our minds to inform the brain, in order to develop and manipulate mental imageries:

> The distinctive feature of brains such as the one we own is their uncanny ability to create maps. Mapping is essential for sophisticated management, mapping and life management to go hand in hand. When the brain makes a map, it *informs* itself. (…) When brains make maps, they are also creating images, the main currency of our minds. Ultimately, consciousness allows us to experience maps as images, to manipulate those images, and to apply reasoning to them. (Damasio 2010: 63)

Secondly, the findings proposed by the In/Pe project include the perception of the body of the auditor in the spaces and inside the mental imageries, especially in Question b) of the questionnaire (e.g. *In which locations, spaces or environments did you see yourself while listening?*) or through the sound of the body (breathing and heartbeat) in *Kinetism*. On the other hand, the portfolio provides contexts where the body of the participants includes motions (e.g. sounds of footsteps in *My Extra Personal Space,* or a stroll in the sound installation in *Kinetism*). Again, neuroscience has important tools in this area towards understanding motor imagery, according to Zatorre and Helpem, who claim that:

> Motor imagery is the imagination of the kinesthetics involved in actual movement and has been examined for both simple tapping and complex musical routines (…) In many musical situations, sound is associated with movement (…) Given the behavioural and neural evidence for people being able to imagine musical movements, is there evidence that auditory and motor imagery may be integrated in the brain? (Zatorre and Halpem 2005: 10)

However, the In/Pe project investigates spatial perception and the movement of the body into architectural spaces within mental imagery as if into electroacoustic contexts relating to loudspeakers, not as movement related to a musical instrument.

Thirdly, in asking the participants to listen to the pieces and to visualise architectural mental imagery, it promoted a deeper listening, a way to focus on the composition, to analyse it, and to concentrate on their own (live) experiences during the listening process. Thus, it possibly creates a link between the composer (intention) and audience (perception), not only through a matter of sound, but by pushing it further as an experience, as proposed by Prinz:

> Conscious experience is not restricted to what is in my head but includes the environment around me, then the richness of experience is not an illusion. Experience really is rich, even though internal representations are sparse. It is rich because experience is partially composed by the world, and the world is rich. The idea that the world is literally a component of conscious experience may sound bizarre, but it has been proposed as a serious possibility. (Prinz in Robbins and Aydede 2009: 423)

The environments in which the sounds were collected were explored while deep listening, allowing a deeper *experience* of the locations through sound. Later, the audience was invited to deep listen to the works, and to visualise in their own mental imagery the architectural spaces, allowing an even deeper experience of the works. The intention of the composer and the perception of the audience are linked through deep listening.

4.4. Future Research

In the future, the direction of the research will consider collaboration with cognitive neuroscience in order to investigate issues of body perception, how the body is perceived in mental imagery and if it includes a sense of agency[87]; it

[87] 'The sense of agency (SA) is the experience that I am the one who is causing or generating the action' (Gallagher 2012:18).

might be useful to merge both disciplines because the breadth of area of the undertaking requires additional knowledge from specialists; it may shed light on auditory mechanisms in relation to mental imageries of perceptions of body, out-of-body experience, and space in electroacoustic contexts. Then, future research needs specialist methods such as fMRI and EEG (Ganis, Thompson, and Kossyln 2004) measurements and virtual reality set-ups in order to project the body of the participants into artificial spaces then to observe the outcomes of such procedures. The methods will rely on multimodal perceptions, and the analysis of the results will be qualitative as well as quantitative.
Collaboration of this nature is paramount since it includes the investigation of body perception (Elk *et al.* 2014; Ionta, Gassert, and Blanke 2011; Menzer *et al.* 2010) in relation to sound (Segal and Fussela 1970). The current questionnaire offers a solid base for the inquiry since the results provide positive answers not only to the research question about architectural space perception in mental imagery, but also about body perception in relation to motions provided by the sounds as described in the current survey. Accordingly, Damasio proposes that:

> The close relationships of body and brain are essential to understanding something else that is central to our lives: spontaneous bodily feelings, emotions and emotional feelings. (Damasio 2010: 92)

Bodily feelings have been explored through bodily sounds, and how they relate to the perception of the self in mental imagery. On that basis, future research will observe how a multimodal environment may trigger emotions and emotional feelings, and how those can be investigated.

Chapter Five
Summary / Conclusion

5.1. Introduction

The study has explored the aesthetic and perceptual issues linked to the mapping of the dynamic relations within sound and space perception. On one level, the map of three different kinds of spaces was defined:

- Real
- Virtual
- Hyperbiological.

Within the map are included the artworks, each piece belonging to more categories of space:

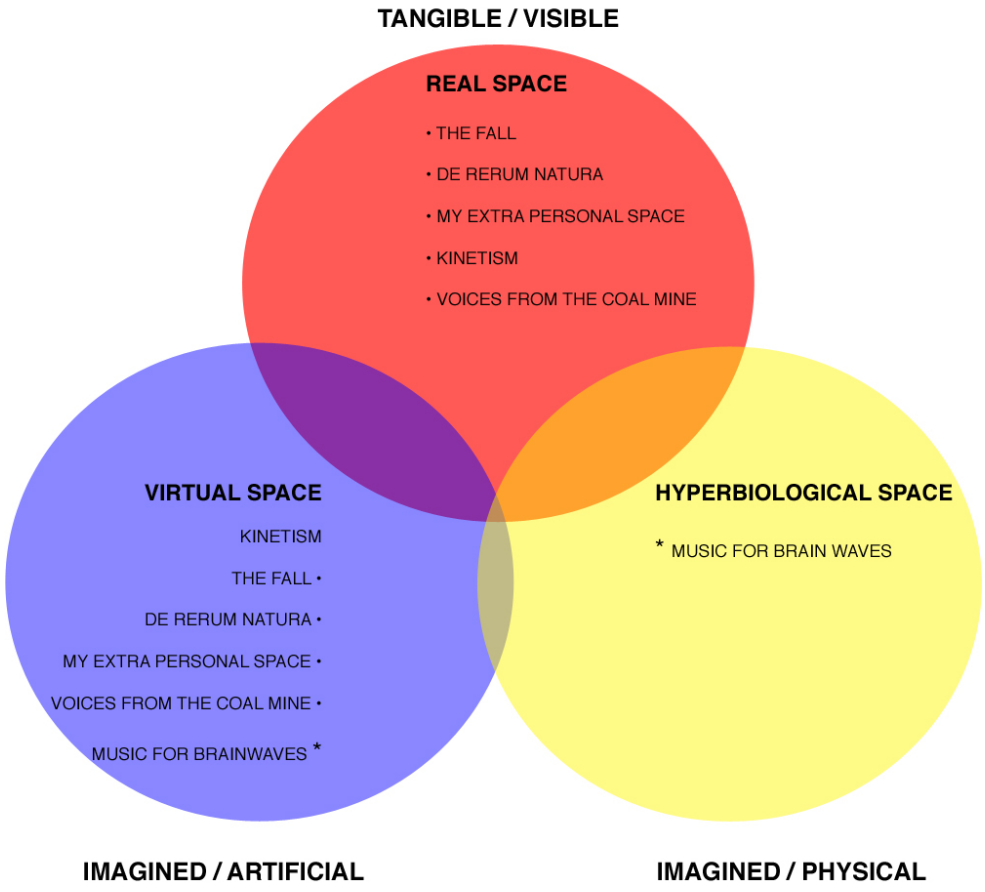

Fig. 5.1 Map of the spaces (original figure number 1.7.3.)

The merger of sound and space was observed through the process of the production of a portfolio of six pieces including fixed media compositions, sound installations, and performances.

On another level, the perception of space was investigated through an empirical survey based on phenomenology. The importance of such study relies on both the role of experience in the arts, and how the investigation of the link between the *intention* of the composer and the *perception* of the audience provides valuable information in the field of practice-led research.
The main questions the study sought to answer were:

- What is the relation between sound and space in sonic arts, and to what kind of merger does it lead?
- What relationship exists between the intention of the composer and the perception of the audience regarding architectural and environmental spaces?
- Is there a common thread of perception of architectural and environmental spaces among participants?
- Is embodiment a key for the perception of the dynamic relations of sound and space?

The exploration of aesthetic and perceptual issues linked to the mapping of the dynamic relations of perceptions of sound and space proved to be in concordance with the hypothesis that a relation exists between the *intention* of the composer and the *perception* of the audience of architectural and environmental spaces.

Firstly, the idea to include the analysis of the audiences' perceptions in order to decipher the composer's artworks added significant strength to the production of the original knowledge to the existing field of practice-based art research. The perception of the audience in relation to the intention of the composer was not meant to influence the compositional process nor the sitting / staging of the work. However, the audience perception was important in order to provide knowledge of and insights into the perception of an artwork, by exploring the external feedback of the audience and by revealing characteristics linked to mental imagery and embodiment; this is instead of being centred on the

perceptions of this author.

Secondly, a wider, clearer understanding of spatial issues in composition was observed, not about the spatialisation of sound *per se,* but in the context of the development of a spatial language in order to communicate issues on the relationships of sound and space as a merger. The language relates to strategies for the development of situations for the artworks proposed as follows:

- *The Fall*

  The compositional language emerging from a discussion with a sculptor leading to a common work by merging the spatial language of the sonic arts and the visual arts;
- *De Rerum Natura*

  The compositional spatial language as a result of deep listening in a particular environment such as the Amazon rainforest and how the deep listening sessions lead to a composition. However, spatial language also becomes a performative language for the consecutive strategic placement of the loudspeakers, the performer, and the audience in the performance space;
- *My Extra Personal Space*

  The spatial language relates to relationships between the sounds from the city of Paris and the sounds from the Normandy coast, and how, as urban material and rural material, these are combined in order to communicate a composition that is perceived as a whole;
- *Kinetism*

  The spatial language communicates the unusual situation emerging from the amplification of bodily sounds heard within urban environmental sounds, with the scope possibly to trigger out-of-body experiences;
- *Music for Brainwaves*

  The spatial language approaches a novel terminology of space defined as hyperbiological space, which consists in sonifying EEG data through an algorithm. The sound produced by the sonification is sent into a

resonant space, which is sensed back by the performer as biofeedback;

- *Voices from the Coalmine*
  The idea relates to a spatial language in the space of the coalmine communicating, metaphorically, issues about a pathology such as autism and how this can be communicated to an audience *via* a sound work.

The spaces were explored and included in three categories (real, virtual, and the original definition of hyperbiological spaces). The space that appeared has always constituted a fundamental and central element of the compositions, and was felt by the audiences. Several possibilities of *mergers* were proposed in the dynamic relations of sound and space. In that respect, the *mergers* of sound and space are a form both of architecture *and* of composition, and will be considered as such, since architecture and composition[88] are, respectively, organised spaces and sounds.
Thirdly, the proposal that the experience *is* the artwork appeared through the aspects of mental imagery and resonance: with bodies, with performance spaces and with audiences. The results thus significantly underscore the role of the embodiment of space in auditory perception.

Section 5.2 presents a synthesis of the empirical findings provided by the six pieces of the portfolio as a) the process of production, and b) the results of the survey into the phenomenology of five pieces (*Voices from the Coalmine* is site-specific only and is thus not included). Section 5.3 includes the theoretical implications of the theme of the embodiment of space in sound perception when cross-comparing the common threads perceived within the portfolio. In this regard, it also presents issues on the mental representations of space in relation to the presentation of the portfolio, the body as a generative interface and the related production of space, the ecological context, the consequent mental phenomenon relating to mental imagery, deep listening, and the content

[88] Extended to sonic arts.

as total sensation of the musical experience. Section 5.4 introduces future research by proposing to continue the investigation alongside neuroscience; this will include neuroimagery and neurophenomenology, and will foster knowledge of human perception, spatial perception, and mental imagery.

5.2. Synthesis of Empirical Findings

The main empirical findings are presented chapter by chapter then proposed in two parts. Firstly, the process of development of the portfolio and the consequent issues raised by the pieces and secondly, the audiences' answers are analysed through the surveys. The survey, informed by phenomenology, showed that a common thread of architectural and environmental spaces was perceived by the participants after sessions of listening to the pieces, after a stroll into the sound installation, or after attending the performance. However, the piece *Voices from the Coalmine*, due to its very site-specific nature, was not part of the survey. Each piece of the portfolio presented below answers the following questions:

1) Does a relationship exist between the *intention* of the composer and the *perception* by the audience of the architectural and environmental spaces included in the composition?

2) Is there a common thread of *perception* of architectural and environmental spaces among participants?

Noteworthy is the context of production in which each piece was developed, because each provided specific knowledge that it would otherwise not be possible to acquire.

5.2.1. *The Fall* Process of Development

The piece, a sound installation and an eight-channel composition belonging to the 'real' and 'virtual' space categories on the map of this research, was developed together with a sculptor; this arose through a discussion that led to the integration of sculptural issues in relation to space into *The Fall*. The relation between sound and space focused mainly on the sound of the recorded close

environment, which was composed and re-injected into the composition during the opening, and was thus properly site-specific (real space). The result relates to a merger of sound and space: the circle of eight loudspeakers project sound around the sculpture project. This leads to another kind of space between the sound composition and the sculpture, which was created during the opening; it was a vibrational space (virtual space), and the merger sought by the interaction of sound and space was unique and ephemeral.

5.2.2. *The Fall* Survey Analysis

1) Since the piece was site-specific and ephemeral, there was, in the perception of the participants to the survey, no trace of the original intention of the composer to create a unified sculpture (a vibrational space) between sound and the original sculpture.

2) Yes, a common thread of perception of architectural spaces appeared as: a) large spaces such as a hall, warehouse, and industrial building, triggered by the sound of the flow of water, and b) smaller spaces such as a cave, tunnel, and pipe, triggered by the sound of the dripping/movement of water. However, there was no sound directly related to the perception of environments, which appeared as a field, landscape, green highlands, and desert.

5.2.3. *De Rerum Natura* Process of Development

The piece, a live electronic composition that fits into the categories of 'real' and 'virtual' spaces on the map of this research, was developed during an expedition to the Brazilian Amazon rainforest. On the one hand, the relation between sound and space emerging from the composition relies on the deep listening procedure developed in the rainforest, given the hazardous issues of the environment. The sounds were further categorised during the composition process in the studio (real spaces). The mental imageries perceived by the composer during the deep listening procedures formed the first draft of the composition and were transferred to the audience.

On the other hand, the projection of the sound masses of the composition in the performance space and the resulting merger relies on the virtual space. Thus, the concerns emerging from *De Rerum Natura* are linked to ideas of the de-territorialisation of the sonic material from the rainforest and re-injected (re-territorialisation) into the performance spaces. It observes how the latter are illuminated by the sound and then created a sonic *moiré,* a polyphony of spaces. The strategies are always different, in response to the respective acoustic properties of the venues, observed, then adapted accordingly by including the audience (e.g. lying on the floor, or casting the space into total darkness). The result is as such ephemeral and site-specific.

5.2.4. *De Rerum Natura* Survey Analysis

1) The intention to share the experience of sounds from the Brazilian rainforest perceived during the deep listening procedure appeared clearly in the answers given by the participants about their perception.

2) No sound triggered specific spaces in the mental imagery of the participants. Nevertheless, a space appeared in many answers and was described as a black confined space, such as a cave and underground. The environment appeared mainly as forest and jungle.

5.2.5. *My Extra Personal Space* Process of Development

The piece, a stereo fixed-medium composition, which fits into the categories of 'real' and 'virtual' spaces on the map of the research, was developed at the INA/GRM (Institut National d'Audivisuel / Groupe de Recherches Musicales) in Paris. The relation between sound and space in this case focuses mostly on the interaction of sound and spaces from natural *vs*. urban contexts, those of the Normandy coast and of Paris, both in France. The compositional process observed their equivalence in term of sonorities in order to create a coherent whole. This contrasts with an approach that focuses on the lo-fi and hi-fi sonorities from urban and natural environments. In another contrast, the perception of sound and space is investigated also through soundwalking and

psychogeography, the main tools for the composition. With these tools, a novel perception of the environments allows the composer to develop the first draft of the composition. However, no references to the places as sonic identities were provided. The composition includes ideas emerging from cinema, such as long, static shots, in tribute to Luc Ferrari's *Presque Rien* series.

The contexts of the production of the composition are paramount in the process (INA/GRM, Bibliothèque Nationale de France François Mittérand, and the Cité Internationale des Arts Residency, all in Paris) since I have been able to discuss and discover information I would otherwise have been unable to acquire:

- The GRM provided invaluable information on the context of the music developed in the Centre, in particular with actors such as Evelyne Gayou, Brunhild Ferrari, Daniel Teruggi, François Bayle, and Diego Losa;
- Bibliothèque Nationale de France François Mittérand included all of the information needed for a deeper investigation into the information collected at the GRM;
- The Cité Internationale des Arts Residency allowed me not only to live in the centre of the city of Paris, but also to discuss issues of electroacoustic music with visual artists and dancers, which provided another perspective into the research.

5.2.6. *My Extra Personal Space* Survey Analysis

1) The intention to present a merger between the sounds of the city and those from nature appeared in the responses as neither a conventional city nor nature. Instead, participants perceived industrial plants, factories, a harbour, a small town, an old town, or a village by the sea, which are somehow mergers of both sound environments (urban and rural). It implies that by merging sounds of both environments, a merging image of city and nature appeared in the results.

2) Three kinds of spaces appeared as a common thread: a) an internal space such as a building, studio, beach house or shelter (although there

were no defined sounds deliberately suggesting such a description); b) factory (this is related to the sound of metal); c) church (this is linked to the sound of the bells). The perceptions of the environment related to coastal areas (ocean, beach, and seashore).

5.2.7. *Kinetism* Process of Development

The piece, a sound installation, which belongs to the 'virtual' category on the map of the research, was developed during an art/science residency at the Brain Mind Institute of the Swiss Institute of Technology in Lausanne, Switzerland. The relation between sound and space focuses mostly on the merger of the external sound environments with the internal sounds of the body. The main development for this piece was to approach virtual space not as a computer-based network of artificial space; rather, the focus was on subjective ideas related to the mind. In addition, the work focused especially on the experience of the participant, and thus the experience became the artwork. The context of the production of the sound installation is paramount in the process (The Brain Mind Institute) since I was exposed to the exceptional advanced research in neuroscience that inspired my research.

5.2.8. *Kinetism* Survey Analysis

1) The intention was to achieve a virtual space created while the participants took a stroll in the diffusion of internal *vs*. external spaces. Their perceptions have been described as an internal space (dreamy and 'fluffy', similar to when one is starting to fall asleep), body, comfortable space or even the impression of nauseous palpitations.

2) The common thread of perception of space were: a) an internal space in relationship to the sound of the body, and b) a church or a cathedral, through associations triggered by the sound of the bells. The environment appeared as presented in the sound installation to be a city market, a park, and the countryside.

5.2.9. *Music for Brainwaves* Process of Development

The piece, a performance, which fits in the 'hyperbiological' space on the map of the research, was also developed during the above-mentioned art/science residency at the Brain Mind Institute of the Swiss Institute of Technology in Lausanne, Switzerland. The main development sought by the piece was to explore the inter-relationship and ecosystem created between bodily data, such as an EEG and linked to Xenakis' Gendy algorithm, leading to the consecutive sound projected into a defined space, and the resulting neurofeedback. This last statement relies on the specific relations of sound and space, which include both the resonant issues of sound and space as a merger, and also the neurofeedback experienced by the performers' bodies; this creates yet another merger which may be experienced only by the performer, and thus the audience shall rely on programme notes for an understanding of the particular feeling of neurofeedback. The context of production of the performance is paramount in the process (The Brain Mind Institute in Switzerland) since I have been exposed to details of both the use and technique of EEG in medical contexts, and public-ready headsets.

The exceptional location of Teufelsberg in Berlin, and its unique acoustics, allowed me to test the performance and achieve particular neurofeedback that would otherwise have been difficult to obtain.

5.2.10. *Music for Brainwaves* Survey Analysis

1) The intention to create a hyperbiological space was mainly perceived by the performer, meaning that he was the primary audience since the neurofeedback was created by his own performance. However, a small fraction of participants mentioned: a) the perception of electrical activity, and b) the perception of urban environments, vast environments, and water, which may relate to the interpretation of the neurofeedback since there was no soundscape relating to a possible imagery, but only a flow of synthetic sound issued by the *Gendy* algorithm.

2) Because the piece was a performance, the perception of mental imageries was diminished in relation to the other pieces; however, an enclosed space such as a room appeared among participants' responses, and the environments were linked to urban and vast environments.

5.2.11. *Voices from the Coalmine* Process of Development

The piece, a sound installation and a performance, which fits into the 'real' and 'virtual' space categories on the map of research, was developed in one week's residency at the Interaktionslabor in Göttelborn, in a former coalmine. *Voices from the Coalmine* is properly site-specific and no audience was present during the performance (Real Space); it thus questions the value of documentation for ephemeral and site-specific works, in this case the only form of experience that one can have of the piece.

The relation between sound and space in *Voices from the Coalmine* focuses mainly on the progressive shaping of sound by space (Virtual Space), following the influence and procedure of Alvin Lucier's iconic piece *I am sitting in a Room.* The main achievement of the piece and dramaturgy relies on the inclusion of the written experience of an autistic person (Sybille) as her own perception of the world in order for me to develop *Voices from the Coalmine*. The context of the production is unique and the development would not otherwise have been possible.

5.3. Theoretical Implications

When comparing the results of the survey among all of the pieces in eliciting perceptions of architectural spaces, similar patterns appeared as follows:

- ***The Fall***: Smaller spaces such as a cave, tunnel, and pipe were triggered by the sound of the dripping/flow of the water in them;
- ***De Rerum Natura***: A dark, confined space (such as a cave and underground);
- ***My Extra Personal Space***: An internal space (a building, studio, beach house, or shelter);

- ***Kinetism***: An enclosed space (inside the human body, a box or a room);
- ***Music for Brainwaves***: A room (apartment, closed room or dark room).

The comparison provides a positive answer to the embodied perception of the research question: *Is embodiment a key for the perception of the dynamic relations of sound and space?* This is since similar typologies of architectural spaces appear in the mental imagery of the candidates when cross-comparing the piece. The answer appears clearly in *Kinetism* since sounds of the body are present in the piece. However, the responses also show similarities to a small closed space. In *The Fall,* the small space is also related to the sound of the dripping/flow.

The mental representation of space through perceptions of the body links to positions already mentioned in the current study at Sections 2.1 and 2.2.2 (Gallagher 2007: 302, Dixon *et al.* 2014). In this regard, Woelert calls for 'the body as the generative interface' and 'human conceptual thought' (Leroi-Gourhan 1993: 313 in Woelert 2011: 115, 116). The body acts as the interface between the physical movement into the *real* environment and the *virtual* mental perception of the world. That is, exterior environment and 'human conceptual thought' (mental imagery here) are not two separate processes; they are closely related and form a whole. The novel knowledge proposed in this research relies on the relationship between the mental representation of architectural and environmental space as demonstrating their embodiment through sound instead of through sight. Accordingly, the areas investigated focused on the *production of space* in relation to the body (Lefebvre 2000: 190). The idea includes the ecological context in which the sonic event is perceived (Gaver 1993; Gibson 1979).

The intention/perception link between the composer and the participants pushes further the idea that 'there is no basic difference in this respect between what happens when a person looks at the world directly and when s/he sits with his eyes closed and thinks' (Arnheim in Johnson in Biggs and Karlsson 2011: 149). The claims proposed by Arnheim differ from the current study, because the

same mental phenomenon or perception of space proposed by Arnheim is not solely for one same person in the current research, but includes the composer and the participant.

Finally, to develop such procedures, the concept of deep listening was a paramount component since it allowed for emphasis on the perception of the environment when recording the sounds in the field for the composer (intention), and for the audience when asked to concentrate on its own mental imagery (perception). That is, the body of the composer, while soundwalking, plays a role in the *production of space.* Therefore, the perception of mental imageries through a dedicated mode of listening (deep listening) by the composer and by the participants leads to an essential link between *intention* and *perception.* It contributes to the creation of patterns of architectural and environmental spaces, which are perceived as a common thread between a) the participants, and b) the pieces.

5.4. Future Directions

Art and science collaboration will be sought for further development of the research, since the actual main limitation of the study has been further investigation of the perception of the auditors' respective bodies in the perceived spaces and environments. Neuroscience is crucial in order to validate more precisely the embodiment of space through the vestibular system and proprioception; this will in turn lead to opportunities for the development of perceptions of space through sound and multimodal environments, including dynamic movements and dynamic situations.

Neurophenomenology will help to shed light on the personal mechanisms of listening and spatial perception in electroacoustic and multimodal contexts. It will achieve this by relying on collaborative methods between neuroimagery and phenomenology. Varela claims that one of the objectives of experimental neurophenomenology is to bridge first-person experience and neurophysiological data (Varela in Bockelman *et al.* 2013aa). This opens up the possibility to delve further, possibly provide novel knowledge, and open

innovative perspectives into the first-person experience. In addition, Gallagher proposes that ‘neither neurophilosophy nor the empirical sciences can afford to ignore phenomenology or neurophenomenology’ (Gallagher 2007: 298). In this regard, future directions will strengthen the collaboration between sonic arts and phenomenological approach with the neuroscientific approach to the perception of the body. That is, the result will be a merger between artworks and scientific experiments, where the artist’s/composer’s *intention* and the participants’ *perceptions* will be observed. This will help to establish dynamic links in multimodal environments (smell, touch, taste, and sound) in order to validate results obtained through the phenomenological approach.

Chapter Six
Bibliography & Discography

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Chapter Seven
APPENDIX

7.2. Documentation (USB Stick)

7.2.1. *The Fall*

- Eight tracks.
- Schema for 8 channels.
- Video footage of location / Neuchâtel / Switzerland.

7.2.2. *De Rerum Natura*

- Live recording lenght 38’36’’/ Lausanne / Switzerland 2009.
- Excerpt 10’.
- Video footage of a concert / Shanghai 2011.

7.2.3. *My Extra Personal Space*

- Composition length 16’16’’.

7.2.4. *Voices From the Coalmine*

- Recording of the process length 6’.

7.2.5. *Kinetism*

- Max / Msp Patch.
- Sound files.
- Video documentary at Brain Mind Institute / Switzerland.

7.2.6. *Music for Brainwaves*

- Max / Msp Patch.
- Video Performance at Teufelsberg / Berlin / Germany.